KEYENCE

281GB

EtherNet/IP Function

KV-EP21V
KV-5500
KV-NC1EP

User's Manual

Please read this Manual before use.
Keep this Manual in a safe place for later reference.



Chapter 1 CONFIGURATION & SPECIFICATIONS
Chapter 2 UNIT INSTALLATION
Chapter 3 UNIT SETTING
Chapter 4 ETHERNET/IP COMMUNICATION
Chapter 5 HOW TO USE ETHERNET/IP SETTING
Chapter 6 OPERATION OF KV DATALINK+ for EtherNet/IP
Chapter 7 SENSOR APPLICATION
Chapter 8 HOST-LINK COMMUNICATION FUNCTION
Chapter 9 MC PROTOCOL COMMUNICATION FUNCTION
Chapter 10 MAIL SEND/RECEIVE
Chapter 11 FTP SERVER
Chapter 12 FTP CLIENT FUNCTION
Chapter 13 SIMPLE PLC LINK FUNCTION
Chapter 14 ACCESS WINDOW
Chapter 15 MONITOR

- Used Devices
- Error List
- Auto Clock Data Adjustment Function

Support CPU Unit

KV-EP21V
- KV-5500
- KV-5000
- KV-3000

KV-NC1EP
- KV-N24**
- KV-N40**
- KV-N60**
- KV-NC32T

Preface

This manual gives an general description of the KV-5500 built-in functions, KV-EP21V and KV-NC1EP, and also describes their functions and how to use them.
Be sure to thoroughly read and fully understand this manual before installing. In addition, store this manual in a safe place so that you can retrieve it whenever necessary.

■ Related manuals

Please also refer to the following manuals when using KV-EP21V, KV-5500 and KV-NC1EP.
All the following PDF manuals can be found and opened in the help file of KV STUDIO. The latest version of PDF manuals can be downloaded from the Keyence web site.
For paper manuals, please call us at contacts in the back cover.

Name	Description	KV-5500 KV-EP21V	KV-NC1EP
KV-5500/5000/3000 Series PLC User's Manual	This manual describes how to connect and maintain KV-5500/5000/3000 series PLC, CPU built-in functions and how to prepare ladder programs.	Included	Not included
KV-5500/5000/3000 Series KV Nano Series Instruction Reference Manual	Introduce various commands available for ladder diagram programming.	Included	Included
KV-5500/5000/3000 Series KV Nano Series Script Programming Manual	This Manual describes script programming and available operators, control statements and functions.	Included	Included
KV STUDIO User's Manual	This manual describes how to operate KV STUDIO.	Included	Included
KV-5500/5000/3000 Series System Macro Manual	This manual describes the system macros available for the KV-5500/5000/3000 Series PLC.	Included	Not included
KV Nano Series (connector type) User's Manual	This manual describes connection and maintenance, built-in functions in the CPU unit, and how to create ladder programs for the KV Nano Series (connector type).	Not included	Included
KV Nano Series (terminal block type) User's Manual	This manual describes connection and maintenance, built-in functions in the CPU unit, and how to create ladder programs for the KV Nano Series (terminal block type).	Not included	Included

Safety Precautions

This manual describes handling, operation, and safety information for the built-in EtherNet/IP function of the KV-5500, the EtherNet/IP Unit KV-EP21V, and the KV-NC1EP.
In order to have optimal use of KV-EP21V and KV-NC1EP, please read this manual carefully and understand the contents before using the units.

■ Symbols

This document contains notices which you should observe to ensure your own personal safety, as well as to protect the product and connected equipment. These notices are highlighted in the manual by a warning triangle and are marked as follows according to the level of danger:

DANGER	**Indicates that death or severe personal injury will result if proper precautions are not taken.**
WARNING	**Indicates that death or severe personal injury will result if proper precautions are not taken.**
CAUTION	**Indicates that death or severe personal injury can result if proper precautions are not taken.**
NOTICE	**Indicates that damage to property can result if proper precautions are not taken.**

Important — **Indicates warning on operations that must be performed.**

Point — **Indicates useful information or information that aids understanding of text descriptions.**

Reference — Indicates useful information or information that aids understanding of text descriptions.

Indicates a reference item or page to be referred to in this manual and other manuals.

■ General Precautions

- Verify that this device functions correctly at startup and during operation.
- Provide a safety circuit that bypasses PLC to enable failsafe operation of the entire system in the event that the PLC fails.
- Output circuit or internal circuit malfunctions sometimes prevent control from being performed normally. Be sure to provide a safety circuit in control systems where circuit malfunction may lead to fire or other serious accidents.
- Proceed with care when modifying the KV-L20R, or when using it in a manner that falls outside of the ranges indicated in its specifications, since KEYENCE is unable to guarantee device functionality or performance in such situations.
- Use this product in combination with other devices only after careful consideration, since the product may fail to satisfy its functionality and performance capabilities as a result of the conditions and environment in which it is used.
- Do not use the product with the purpose of protecting human beings.

■ Requests

When using this device under the following conditions or operating environments, please consult with your KEYENCE agents in addition to implementing safety measures such as product operation that allows redundancy with respect to ratings and functions and use of failsafe provisions.

- Use of the product under conditions not described in this manual.
- Use of the product in nuclear power generation control, railroad facilities, aviation facilities, vehicles,combustion devices, medical equipment, entertainment machinery, safety equipment, etc.
- Use in applications where a major influence to human life and property is anticipated, and where safety in particular is required.

■ CE Marking/UL Standard

For descriptions relating to the restrictions on the CE Marking and descriptions relating to the restrictions on compiling with the UL508, see 🕮 "KV-5500/5000/3000 Series User's Manual", "KV Nano Series (connector type) User's Manual", "KV Nano Series (terminal block type) User's Manual".

How This Manual Is Organized

Chapter 1	CONFIGURATION & SPECIFICATIONS	This chapter describes the features, name and function of parts, as well as specifications of the KV-5500 EtherNet/IP function, KV-EP21V, and KV-NC1EP.
Chapter 2	UNIT INSTALLATION	This chapter describes the installation environment of the KV-5500 EtherNet/IP function, KV-EP21V and KV-NC1EP, as well as how to install it on the CPU unit, and how to connect it to the Ethernet.
Chapter 3	UNIT SETTING	This chapter describes the unit setting of EtherNet/IP Units.
Chapter 4	EtherNet/IP COMMUNICATION	This chapter describes the operating principles and functions of EtherNet/IP communication, as well as necessary communication settings.
Chapter 5	HOW TO USE EtherNet/IP SETTING	Cyclic (I/O) messages between EtherNet/IP Units and EtherNet/IP Devices and other functions can be set up using the EtherNet/IP Settings attached to KV STUDIO. This chapter describes how to operate EtherNet/IP Setting.
Chapter 6	OPERATION OF KV DATALINK+ for EtherNet/IP	By using the KV DATALINK+ for EtherNet/IP attached to KV STUDIO, following the instructions and entering the necessary information, setting data sending and receiving to and from the EtherNet/IP scanner can be carried out easily. This chapter describes how to operate KV DATALINK+ for EtherNet/IP.
Chapter 7	SENSOR APPLICATION	This chapter describes the operating principle and function of sensor application function, as well as necessary settings.
Chapter 8	HOST-LINK COMMUNICATION FUNCTION	This chapter describes the operating principle, communication settings, command and response of host-link communication.
Chapter 9	MC PROTOCOL COMMUNICATION FUNCTION	This chapter describes the operating principle, communication settings, command and response of MC protocol communication.
Chapter 10	MAIL SEND/ RECEIVE	This chapter describes the operating principle, and communication settings of mail send/receive.
Chapter 11	FTP SERVER	This chapter describes, using FTP, how to get device value of CPU unit, how to read/write memory card, how to operate/stop CPU unit, and how to operate access window.
Chapter 12	FTP CLIENT FUNCTION	This chapter describes how to upload/download files using FTP client function after the connection with FTP server.
Chapter 13	SIMPLE PLC LINK FUNCTION	This chapter describes how to build data link by using simple PLC link function.
Chapter 14	ACCESS WINDOW	This chapter describes how to operate the EtherNet/IP Unit access window.
Chapter 15	MONITOR	This chapter describes monitor function and use methods with KV STUDIO.
	APPENDIX	This chapter describes dimensions, device list, error list and troubleshooting for the KV-5500 EtherNet/IP function, KV-EP21V and KV-NC1EP. It also describes auto clock data adjustment function.

Contents

Safety Precautions....1
How This Manual Is Organized....3
How to Use This Manual....16
How to use mnemonic list....16
Terminology....17
Check the Package Content....18
Difference between KV-EP21V, KV-NC1EP and KV-LE21V....19

Chapter 1 CONFIGURATION & SPECIFICATIONS

1-1 About EtherNet/IP Units....1-2
What is EtherNet/IP....1-2
Overview of EtherNet/IP Unit functions....1-4
1-2 Names of Parts....1-6
1-3 Specifications....1-8

Chapter 2 UNIT INSTALLATION

2-1 Check Installation Environment....2-2
2-2 Installing on CPU Units (base unit)....2-3
Installing on a DIN rail....2-7
2-3 Connecting to Ethernet....2-8
Applicable cable....2-8
Ethernet Switch Used....2-9
Connector for EtherNet/IP Units....2-12
Connecting EtherNet/IP Units to the Ethernet....2-13
Direct Connection between EtherNet/IP Unit and PC....2-14
Precautions on Building Ethernet....2-15
2-4 Maintenance and Service....2-16

Chapter 3 UNIT SETTING

3-1 Unit Editor Setting....3-2
What is Unit Editor....3-2
How to Set Up Using Unit Editor....3-2
Setting Item List....3-4
3-2 Set up Individual Items....3-6
Basic....3-6
Port No.....3-8
Routing Setting....3-10
EtherNet/IP Setting....3-11
FTP Client Setting....3-13
FTP Server Setting....3-14
Simple PLC Link Setting....3-14
MC Protocol Communication....3-15
Mail Setting....3-15
Auto Clock Data Adjustment Function....3-15

Chapter 4 EtherNet/IP COMMUNICATION

4-1 Overview of EtherNet/IP Communication Functions....4-2
Overview of EtherNet/IP Communication Function....4-2
4-2 Overview of EtherNet/IP Communication Functions and Setting Tools....4-5
Relationship of EtherNet/IP Communication Functions and Setting Tools....4-5
4-3 Cyclic (I/O) Messages Function....4-6
Overview....4-6
From Cyclic (I/O) Messages Setting Steps to Operation....4-9
Unit Editor Setting for Cyclic (I/O) Messages Function....4-11
Scan List Settings....4-12
Target EtherNet/IP Device Setting....4-15
EtherNet/IP Unit (Originator) Unit Settings....4-19
Start and Stop of Cyclic (I/O) Messages....4-21
Connection Settings....4-24
Tag Setting....4-38
Device Assignment for Cyclic (I/O) Messages Data....4-42
Refresh CPU Device and Communication Data....4-50
Calculation and Restriction of Communication Load (Load Factor)....4-56
Communication Load Factor Estimate when Using Peripheral Function....4-60
Cyclic (I/O) Messages Communication Time (Delay Time)....4-62
Devices and Programs used in Cyclic (I/O) Messages....4-63
Cyclic (I/O) Messages Stop Request and Restart Request....4-67
Special Command for Cyclic (I/O) Messages....4-69
RFSCI Cyclic (I/O) messages input refresh....4-70
RFSCO Cyclic (I/O) messages output refresh....4-74
U_CSTOP Specify cyclic (I/O) messages stop request object node....4-78
U_CSTRT Specify cyclic (I/O) messages restart request object node....4-80
U_CREG Read cyclic (I/O) messages registered error node table....4-82
U_CERR Read cyclic (I/O) messages error node table....4-84
Specific Function for Cyclic (I/O) Messages....4-86
RFSCI Cyclic (I/O) messages input refresh....4-88
RFSCO Cyclic (I/O) messages output refresh....4-90
U_CSTOP Specify cyclic (I/O) messages stop request object node....4-92
U_CSTRT Specify cyclic (I/O) messages restart request object node....4-93
U_CREG Read cyclic (I/O) messages register node table....4-94
U_CERR Read cyclic (I/O) messages error node table....4-95
4-4 Explicit Messages (Client) Function....4-96
Overview....4-96
Data Format of Explicit Messages (Client) Function....4-97
Unit Editor Setting Related with Explicit Messages (Client) Function....4-98
Device used for Explicit Messages Communication....4-99
Explicit Messages Steps....4-102
Sample Program of Explicit Messages (Client) Function....4-103
Unit-specific Command for Explicit Messages....4-105
U_MSGTO Specify explicit messages object....4-106
U_MSGSND Write explicit messages send data....4-108
U_MSGRCV Read explicit messages receive data....4-110

U_MSGST Read explicit messages complete code....4-112
Unit-specific Function for Explicit Messages....4-114
U_MSGTO Specify explicit messages object....4-115
U_MSGSND Write explicit messages send data....4-116
U_MSGRCV Read explicit messages receive data....4-117
U_MSGST Read explicit messages complete code....4-118
4-5 Explicit Messages (Server) Function....4-119
Overview....4-119
Unit Editor Setting Related with Explicit Messages (Server) Function....4-121
Communication Format and Processing Flow....4-122
How to Use Object Table....4-125
PLC Object (Class ID: 65H)....4-126
Identity Object (Class ID: 01H)....4-140
Message Router Object (Class ID: 02H)....4-143
Assembly Object (Class ID: 04H)....4-144
Connection Manager Object (Class ID: 06H)....4-145
TCP/IP Interface Object (Class ID: F5H)....4-147
Ethernet Link Object (Class ID: F6H)....4-150
CIP General Status List....4-153
4-6 Node Status Acquisition Function....4-155
Overview....4-155
Unit Editor Setting Related with Node Status Acquisition Function....4-156
Device Used in Node Status Acquisition Function....4-157
Steps and Reference Program of Node Status Acquisition Function....4-159
Unit-specific Command for Node Status Acquisition Function....4-161
U_NDTO Specify node status acquisition object....4-162
U_NDSTAT Read node status acquisition result....4-164
U_SLREG Read register node table....4-166
Unit-specific Function for Node Status Acquisition Function....4-168
U_NDTO Specify node status acquisition object....4-169
U_NDSTAT Read node status acquisition result....4-170
U_SLREG Read scan list register node table....4-171
4-7 Appendix....4-172
Data Type and Device Storage Mode....4-172
Command Related with CIP Data....4-174
CPMSET CIP message creation....4-175
CPMGET CIP messages acquisition....4-180
RCPSASC Reverse conversion of CIP character string type data....4-184
CPSASC Reverse conversion of CIP character string type data....4-186
Function Related with CIP Data....4-188
CPMSET CIP message creation....4-189
CPMGET CIP messages acquisition....4-191
RCPSASC CIP character string reverse conversion....4-193
CPSASC CIP character string conversion....4-195

Chapter 5 HOW TO USE EtherNet/IP SETTING

5-1 EtherNet/IP Setting 5-2
- What is EtherNet/IP Settings 5-2
- Function of EtherNet/IP Setting 5-3
- Setting Procedures 5-4

5-2 Startup and Exit of EtherNet/IP Setting 5-7
- Startup of EtherNet/IP Setting 5-7
- Exit EtherNet/IP Setting 5-7

5-3 Name and Function of Parts of Screen 5-8

5-4 Scan List Area 5-9
- Overview of Scan List Area 5-9
- Display Contents of Scan List Area 5-10
- Register Unit to Scan List 5-12
- Deletion of EtherNet/IP Device 5-14

5-5 EtherNet/IP Device Area 5-15
- Overview of EtherNet/IP Device Area 5-15
- "Unit List" Tab 5-16
- "Unit Setting" Tab 5-22
- "Search Unit" Tab 5-24

5-6 Setting 5-31
- Connection Settings 5-31
- Tag Settings 5-32
- Device Assignment Settings 5-33
- Setup Backup Sensor Settings 5-35
- Setup Batch Transmission Sensor Settings 5-35

5-7 Output Window 5-36
- Overview of Output Window 5-36
- "Message" Tab 5-36
- "Verify" Tab 5-37
- "Setup List" Tab 5-38

5-8 File 5-46
- Import 5-46
- Application 5-47
- Close 5-47

5-9 Edit 5-48
- Cut/Copy/Paste 5-48
- Delete 5-48
- Scan list 5-49

5-10 Convert 5-51
- Jump to Error Rung 5-51
- All Unit Auto Assignment 5-51
- Auto assignment within unit 5-51
- Setting Check 5-52

5-11 Communication/Tool 5-53
Verify with Real Machine 5-53
Explicit Messages 5-54
Transmission Adapter Settings 5-55
Startup of KV DATALINK+ for EtherNet/IP 5-55
Calculate Cyclic (I/O) Messages Load Factor 5-55
5-12 Transmission Adapter Settings 5-56
Features of Transmission Adapter Settings Function 5-56
Startup and Exit of Transmission Adapter Settings Function 5-56
Name and Function of Each Part of Transmission Adapter Settings 5-57
File 5-61
Execution of Transmission Adapter Settings (Communication) 5-63
Communication Option 5-66
5-13 Calculate Cyclic (I/O) Messages Load Factor 5-67
Overview of Cyclic (I/O) Messages Load Factor Calculation 5-67
Display the "Calculate Cyclic (I/O) Messages Load Factor" Dialog Box 5-67
Name and Function of the Parts in "Calculate Cyclic (I/O) Messages Load Factor " Dialog Box 5-68
5-14 View/Help 5-72
Toolbar/Status Bar/Output Window 5-72
Switching of Edit Area 5-73
How to Use EtherNet/IP Setting 5-73

Chapter 6 OPERATION OF KV DATALINK+ for EtherNet/IP

6-1 Overview of KV DATALINK+ for EtherNet/IP 6-2
Function of KV DATALINK+ for EtherNet/IP 6-2
Setting 6-3
6-2 Startup and Exit KV DATALINK+ for EtherNet/IP 6-4
Startup 6-4
Exit 6-4
6-3 Name and Function of Parts of Screen 6-5
6-4 Data Link Setup Procedures 6-7
Data Link Setup Procedures 6-7
6-5 How to Operate Setup Wizard 6-11
How to Operate Setup Wizard 6-11
Data can be Sent/Received via Setup Wizard Setting 6-15
6-6 View Setting 6-19
Register Scanner View 6-19
tag setting view 6-21
Connection Setting View 6-25
Connection Settings Updated to the KV STUDIO Project 6-33
6-7 Update to the KV STUDIO Project 6-34
Update to the KV STUDIO Project 6-34
6-8 Other Functions 6-37
File 6-37
Edit 6-41

View....6-44
Transition....6-47
Tool....6-48
Help....6-49

Chapter 7 SENSOR APPLICATION

7-1 Sensor Application Function....7-2
Overview....7-2
7-2 Procedures of Sensor Application Setting....7-3
Procedures of Sensor Application Setting....7-3
7-3 Common Contents of Sensor Application....7-4
Settings in Unit Editor Related to Sensor Application....7-4
Simultaneous Execution of Sensor Application Functions....7-4
Compatibility Check for Sensor Application....7-5
VT Sensor Application Screen Forced Switching Relay....7-6
Progress and Log Monitor of Sensor Application Functions....7-6
7-4 Backup Sensor Settings....7-7
Overview....7-7
Backup Sensor Settings File....7-10
Setting Details of Backup Sensor Settings....7-11
Execution of Backup Sensor Settings Function with VT3 Series....7-14
Execute Backup Sensor Settings Function from Ladder Program....7-18
Attentions on using the Backup Sensor Settings Function....7-30
Unit-specific Command for Backup Sensor Settings Function....7-33
U_SBMON Obtain backup sensor settings execution status....7-34
U_SBNAME Read backup sensor settings file name....7-36
Unit-specific Function for Backup Sensor Settings Function....7-38
U_SBMON Obtain backup sensor settings execution status....7-39
U_SBNAME Obtain backup sensor settings file name....7-40
7-5 Sensor Monitor....7-41
Overview....7-41
Settings of Sensor Monitor Function....7-43
Settings of Sensor Monitor Function....7-44
Contents of the Sensor Monitor Screen of VT3 Series....7-45
7-6 Batch Transmission Sensor Settings....7-48
Overview....7-48
Setting Details of Batch Transmission Sensor Settings....7-51
Devices used in Batch Transmission Sensor Settings Function....7-55
Batch Transmission Sensor Settings Read/Write Steps and Reference Program....7-59
Notice on using Batch Transmission Sensor Settings Function....7-64
Unit-specific Command/Function for Batch Transmission Sensor Settings Function....7-67
U_STMON Acquire execution status of batch transmission sensor settings....7-68
U_STMON Acquire execution status of batch transmission sensor settings....7-70

7-7 Sensor Setting Commands 7-71
Overview 7-71
Notice on Sensor Setting Command 7-74
Sensor Setting Command List 7-75
SPRD Sensor parameter read 7-76
SPWR Sensor parameter write 7-80
SSVC (sensor service execution) 7-84
Sensor Setting Function List 7-88
SPRD Sensor parameter read 7-90
SPWR Sensor parameter write 7-92
SSVC sensor service execution 7-94
7-8 Complete Code 7-96
List of the Complete Codes of the Sensor Application Functions 7-96
7-9 Appendix 7-103
Supported Data Type and Storage Mode 7-103

Chapter 8 HOST-LINK COMMUNICATION FUNCTION

8-1 Host-link Communication Function 8-2
8-2 Communication Specification 8-3
Setting Items of Unit Editor 8-3
Communication Specification 8-4
Devices Used for Host-link Communication 8-4
8-3 Communication Procedure 8-5
Communication Principle 8-5
Command and Response Format 8-6
8-4 Command List 8-8
8-5 Description of the Commands and Responses 8-9
Mn Change Mode 8-9
ER Clear Error 8-10
?E Confirm Error No. 8-10
?K Query Model 8-12
?M Confirm Operating Mode 8-12
WRT Time Setting 8-13
Forced Set "ST"/Forced Reset "RS" 8-14
Continuous Forced Set "STS"/Continuous Forced Reset "RSS" 8-15
Data Read "RD"/Consecutive Data Read "RDS" 8-16
Read Consecutive Data "RDE" 8-20
Write Data " WR"/Write Consecutive Data "WRS" 8-21
Write Consecutive Data "WRE" 8-23
Write Set Value "WS"/Write Consecutive Set Value "WSS" 8-23
Register Monitor "MBS"/"MWS" 8-24
Read Monitor "MBR"/"MWR" 8-27
Read Comments "RDC" 8-28
BANK Switching "BE" 8-29
Read Expansion Unit Buffer Memory "URD" 8-30
Write Expansion Unit Buffer Memory "UWR" 8-31
Response in case of exception 8-32

XYM Expression 8-33
Data simultaneity when the data format is specified as .D/.L 8-33

Chapter 9 MC PROTOCOL COMMUNICATION FUNCTION

9-1 MC Protocol Communication Function 9-2
9-2 Communication Specification 9-3
Check Settings in Unit Editor 9-3
MC Protocol Communication Specification 9-4
Device used for MC Protocol Communication 9-5
9-3 Communication Procedure 9-6
Communication Principle 9-6
Data Format of MC Protocol 9-7
Data Format of Header 9-7
Application Data Format 9-8
9-4 Command List 9-12
9-5 Description of the Command and Response 9-13
Notices on using Commands 9-13
Batch Read [0401] 9-17
Batch Write [1401] 9-18
Random Read [0403] 9-19
Random Write [1402] 9-20
Register Monitor [0801] 9-21
Read Monitor [0802] 9-22
Batch Read Multiple Blocks [0406] 9-23
Batch Write Multiple Blocks [1406] 9-24
Read Buffer Memory [0613] 9-25
Write Buffer Memory [1613] 9-25
Read Intelligent Unit Buffer Memory [0601] 9-26
Write Intelligent Unit Buffer Memory [1601] 9-27
Remote RUN [1001] 9-28
Remote STOP [1002] 9-28
Read CPU Model [0101] 9-29
Loopback Test [0619] 9-30
End Code in case of Communication Error 9-31

Chapter 10 MAIL SEND/RECEIVE

10-1 Mail Send/Receive 10-2
Overview of Mail Send/Receive 10-2
10-2 Basic Settings of Mail Send/Receive 10-4
Check Settings in Unit Editor 10-4
Startup of Mail Setting Tool 10-5
Basic 10-6
Sender/Receiver Group 10-7

10-3 PLC Event Mail Sending 10-8
Overview of PLC Event Mail Sending 10-8
PLC Event 10-9
Mail Send Example 10-14
10-4 Logging/Tracing Mail Sending 10-15
Overview of Logging/Tracing Mail Sending 10-15
Logging/Tracing 10-16
Mail Send Example 10-18
10-5 Mail Sending Based on Ladder 10-19
Overview of Mail Sending Based on Ladder 10-19
Mail Content Setting Method 10-19
The Device Used in the Mail Send/Receive Function 10-20
Mail Send Procedure 10-21
Mail Send Complete Code List 10-22
10-6 Unit-specific Command for Mail Send 10-23
Unit-specific Command List 10-23
U_MLTOGR receiver group setting 10-24
U_MLTO receiver address setting 10-26
U_MLSUB title setting 10-28
U_MLTEXT text setting 10-30
U_MLATTA mail attachment name setting 10-32
U_MLSTAT acquires the sending result 10-34
10-7 Unit-specific Function for Mail Send 10-36
Unit-specific Function List 10-36
U_MLTOGR receiver group setting 10-37
U_MLTO receiver address setting 10-38
U_MLSUB title setting 10-39
U_MLTEXT text setting 10-40
U_MLATTA mail attachment name setting 10-41
U_MLSTAT acquires the sending result 10-42
10-8 Mail Command Receiving 10-43
Overview of Mail Command Receiving Function 10-43
Setting of Mail Command Receiving Function 10-44
Command List 10-45
Special Command for Mail Command Receiving Function 10-46
Format of Command Mail 10-47
Precautions for Mail Receiving and Command Execution 10-47
Reply Mail 10-47
Reply Mail in case of Error 10-48
10-9 Mail Command Maker 10-49
Overview of Mail Command Maker 10-49
Startup of Mail Command Maker 10-49
Use Mail Command Maker to Create Command Mail 10-49

Chapter 11 FTP SERVER

11-1 FTP Server 11-2
FTP Overview of FTP Server Function 11-2
FTP Specification of EtherNet/IP Units 11-3
FTP Functions and Operating Principle 11-4
11-2 FTP Server Function of EtherNet/IP Units 11-5
Check and Change of Operating Mode 11-5
Structure of Directory 11-6
Read/Write Memory Card 11-9
Read CPU Unit Device Value 11-17
11-3 FTP Operation with Internet Explorer 11-21
Procedures of executing FTP with Internet Explorer 11-21
Restrictions on FTP Function Under Internet Explorer 11-23
11-4 FTP Operation Based on Command Prompt 11-24
FTP start and log-in 11-24
File Reading and Writing 11-26
11-5 FTP Command List 11-28

Chapter 12 FTP CLIENT FUNCTION

12-1 FTP Client Function Overview 12-2
FTP Client Function Overview 12-2
FTP Client Setting Tool 12-3
Specification of FTP Client Function 12-3
Precautions on Using FTP Client Function 12-4
12-2 FTP Client Function Setting 12-5
Check Settings in Unit Editor 12-5
Starting FTP Client Setting Tool 12-6
Basic (Tab) 12-7
12-3 FTP File Transfer 12-10
FTP File Transfer Overview 12-10
Necessary Setting for FTP File Transfer 12-12
Device Used in FTP File Transfer 12-19
Steps of FTP File Transfer 12-25
Steps of FTP File Transfer Interrupt 12-26
Program for FTP File Transfer 12-26
Unit-specific Commands/Functions for FTP File Transfer 12-29
U_FCSTAT Read transfer status 12-30
U_FCSTAT Read transfer status 12-32
12-4 Logging/Tracing Transfer 12-33
Logging/Tracing Transfer Overview 12-33
Necessary Setting of Logging/Tracing Transfer 12-34
Device Used for Logging/Tracing Transfer 12-36
12-5 Other Functions 12-37
Check the Log of FTP Client Function 12-37

Chapter 13 SIMPLE PLC LINK FUNCTION

13-1 Simple PLC Link Function Overview 13-2
Simple PLC Link Function Overview 13-2
Simple PLC Link Setup Tool 13-3
Specification of Simple PLC Link Function 13-4
Supported Link Units and Necessary Settings 13-5
Supported Devices 13-11
Precautions on using Simple PLC Link 13-13
Data Update Interval 13-14
13-2 Setting of Simple PLC Link Function 13-16
Check Settings in Unit Editor 13-16
Startup and Default Setting of Simple PLC Link Setup Tool 13-17
PLC Link Setting 13-18
Communication Setting 13-19
13-3 Device and Command of Simple PLC Link Function 13-20
Devices Used in Simple PLC Link Function 13-20
Unit-specific Commands for Simple PLC Link 13-23
U_ELSTAT Read status 13-24
U_ELCYC Read period 13-26
Unit-specific Functions of Simple PLC Link 13-28
U_ELSTAT Read status 13-29
U_ELCYC Read period 13-30

Chapter 14 ACCESS WINDOW

14-1 Access Window 14-2
What is Access Window 14-2
Settings in Access Window 14-3
Menu Structure 14-3
Operating the Access Window 14-4
Moving to Menu Screen 14-5
14-2 Setting Screen 14-7
Baud Rate (Communication Rate) 14-7
IP Address 14-8
Other Setting Items 14-10
14-3 Monitor Screen 14-12
Monitor Method 14-12

Chapter 15 MONITOR

15-1 Unit Monitor 15-2
Unit Monitor Overview 15-2
Display of Unit Monitor 15-2
15-2 Workspace Monitor 15-11
Display of Workspace Monitor 15-11
Right-click Menu of Workspace Monitor 15-12

APPENDIX

1 Devices Used by EtherNet/IP Units A-2
Number of Used Device A-2
Common Devices Used in EtherNet/IP Units A-2
Device used for the EtherNet/IP Unit Functions A-4
2 Communication without Unit Setting/BOOTP A-5
What is BOOTP A-5
IP Address Setting Procedure When BOOTP is Used A-5
Communication without Unit Setting A-6
3 Changing IP addresses A-7
4 Error List A-8
Setting Error List A-9
Cyclic (I/O) Messages Error List A-10
5 Troubleshooting A-16
6 Auto Clock Data Adjustment Function A-39
Overview of Auto Clock Data Adjustment Function A-39
SNTP Function and Configuration A-39
Specification of Auto Clock Data Adjustment Function A-39
Device used by Auto Clock Data Adjustment Function A-40
Error on using Auto Clock Data Adjustment Function A-40
Steps for Setting Auto Clock Data Adjustment Function A-41
7 EtherNet/IP Route Connection Function A-42
EtherNet/IP Route Connection A-42
8 Dimension A-43
9 ASCII Code Table A-44
10 Index A-45

How to Use This Manual

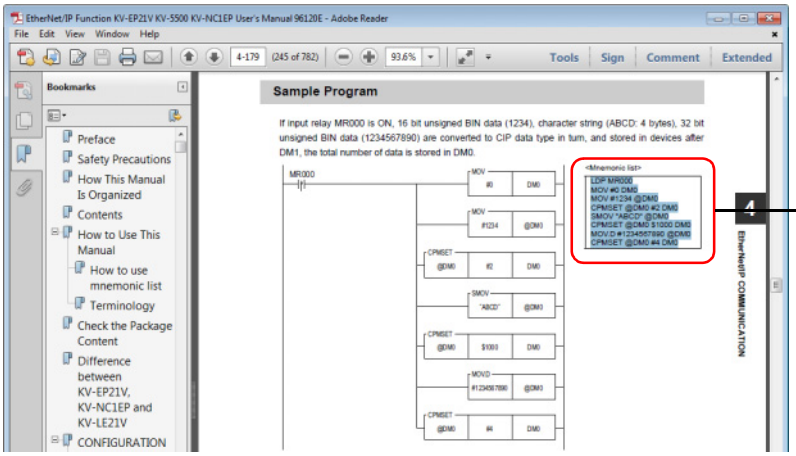
The following describes how to use the sample ladder program (mnemonic list) mentioned in this manual.

How to use mnemonic list

Mnemonic list is recorded in the pages describing reference ladder program.
With the mnemonic list, ladder program can be input conveniently.

1 **Display manual in "Adobe Reader".**

2 **Copy mnemonic list using "Selection Tool".**



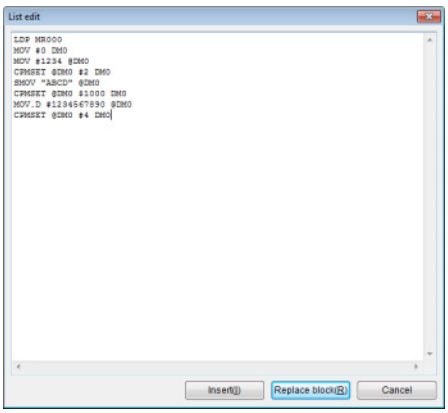
Drag the entire mnemonic list for copy.

3 **Click the cell for inserting reference ladder program in ladder edit area of KV STUDIO, select "Edit(E) " ► "Edit list(L) " from the menu to display "Edit list" dialog box.**

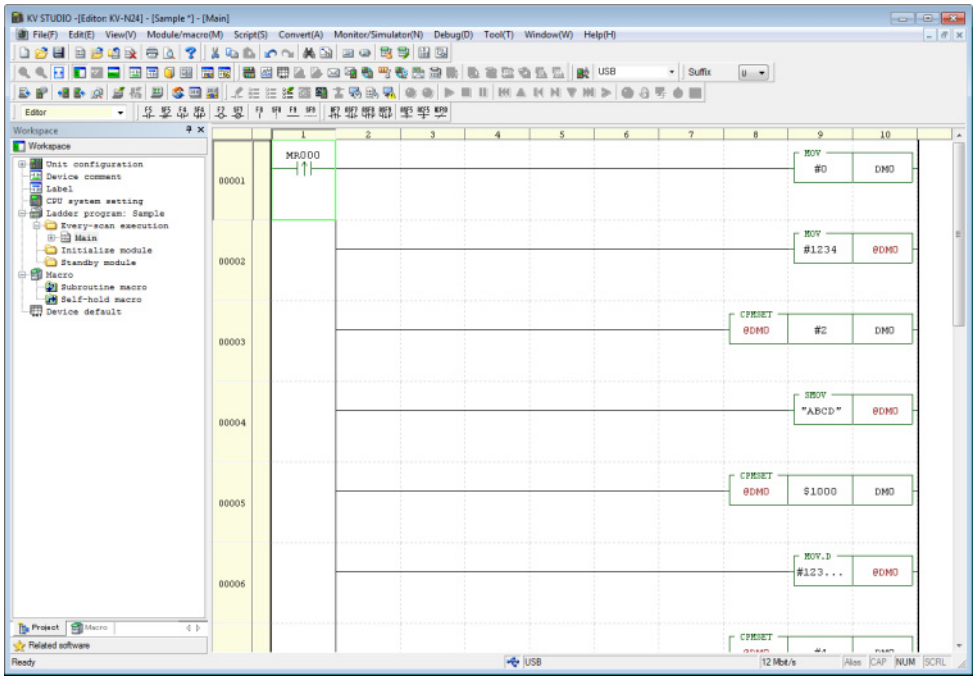
Other

- Ctrl + D

Paste the copied mnemonic list in the displayed "Edit list" dialog box.
Select "Paste(P)" from the right-click menu of “Edit list”dialog box to paste.



4 **Click "Insert (I)" to display the reference ladder program.**



Terminology

The following terminologies are used for description except for some contents in this manual.

Terminology	Description
CPU Unit	KV-5500/5000/3000 Series PLCs (CPU function version 2 or above) from Keyence Ltd.
Base unit	This refers to the PLC KV Nano Series (CPU function version 2 or later) from Keyence Ltd.
Expansion unit	This refers to I/O expansion unit and special expansion unit other than CPU unit.
PLC	This refers to Programmable Logic Controller.
KV STUDIO	KV STUDIO Ladder Support Software
Ladder program	The program made with Ladder Support Software.
EtherNet/IP Unit	The KV-EP21V, KV-NC1EP and KV-5500 units which can use EtherNet/IP functions from Keyence Ltd. For KV-5500, this refers to the EtherNet/IP functions in the CPU unit.
EtherNet/IP setting	The setting tool EtherNet/IP Setting attached to KV STUDIO, used for EtherNet/IP communication.
KV DATALINK+ for EtherNet/IP	The KV DATALINK+ for EtherNet/IP software attached to KV STUDIO, which is used to set PLC data links.
KV COM+	The general name of data acquisition/transfer/monitor softwares KV COM+ for EXCEL and KV COM+ Library.

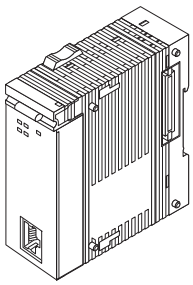
Check the Package Content

The package contains the following equipment and accessories.Before you start using the unit, make sure that the package contains everything that it is supposed to contain.

KV-5500

See the KV-5500/5000/3000 Series User's Manual.

KV-EP21V



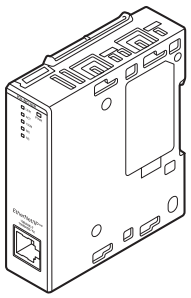
Unit

KV-5500/5000/3000/1000/700 Series

Special unit Instruction Manual

"KV-5500/5000/3000/1000/700 Series" special unit Instruction manual

KV-NC1EP



Unit

KV Nano Series

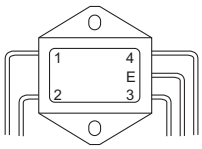
Special unit Instruction Manual

"KV Nano Series" special unit Instruction manual

■ Related items not included in the package of this product

- **Use noise filter OP-25841**

"Precautions on using a DC power supply", page 2-15



- **KV Series EtherNet/IP Function User's Manual (this manual)**

Difference between KV-EP21V, KV-NC1EP and KV-LE21V

The difference between EtherNet/IP unit KV-EP21V, KV-NC1EP and Ethernet unit KV-LE21V from KEYENCE is as follows.

For details on Ethernet unit KV-LE21V, see 📖 KV-LE21V User's Manual. The difference between KV-5500 built-in EtherNet/IP functions and the KV-5000 built-in Ethernet functions is equivalent to the difference between KV-EP21V and KV-LE21V shown below.

■ Difference

Function		KV-EP21V	KV-NC1EP	KV-LE21V
EtherNet/IP communication	Cyclic (I/O) messages	○	○	×
	Explicit messages (client)	○	○	×
	Explicit messages (server)	○	○	×
	Node status acquisition	○	○	×
	Sensor application	○	○	×
Higher-level link communication		○	○	○
MC protocol communication		○	○	○
Mail send/receive		○	○	○
FTP server		○	○	○
Auto clock data adjustment		○	○	○
FTP client		○	○	○
Simple PLC link		○	○	○
BOOTP client		○	○	○
KV socket communication		×	×	○

■ Applicable KV STUDIO version

	KV-EP21V	KV-NC1EP	KV-LE21V
KV STUDIO	Ver.6.0 or above	Ver.7.1 or above	Ver.5.6 or above

■ Supported CPU unit

Unit	Supported CPU unit	Remarks
KV-EP21V	KV-5500/5000/3000	CPU function version 2 or above
KV-NC1EP	KV Nano Series (Excluding KV-N14**)	CPU function version 2 or above
KV-LE21V	KV-5500/5000/3000	
	KV-1000 KV-700	It is compatible with Ethernet unit KV-LE20A from KEYENCE.

MEMO

1

CONFIGURATION & SPECIFICATIONS

This chapter describes the features, name and function of parts, as well as specifications of the KV-5500 EtherNet/IP function, KV-EP21V, and KV-NC1EP.

1-1 About EtherNet/IP Units 1-2
1-2 Names of Parts. 1-6
1-3 Specifications 1-8

1-1 About EtherNet/IP Units

This section gives a general description of EtherNet/IP Units (KV-EP21V, KV-NC1EP and KV-5500) and various communication functions.

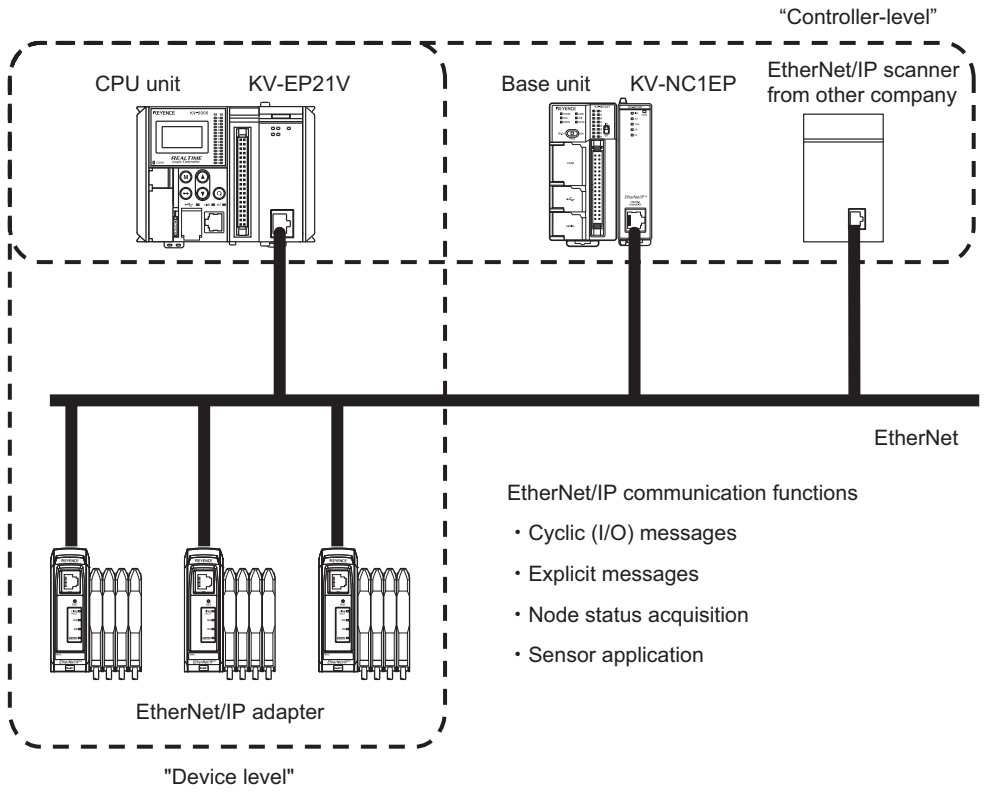
What is EtherNet/IP

■ Overview of EtherNet/IP

As worldwide specifications, EtherNet/IP is an industrial, multivendor network system, which adopts open-sourced Ethernet and is maintained/extended by (Open DeviceNet Vendor Association, inc.) ODVA. EtherNet/IP enables to build controller-level network and device-level field network among EtherNet/IP Devices. Meanwhile, as lower layer protocol, it allows to be used together with the network of general Ethernet units due to standard Ethernet adopted.

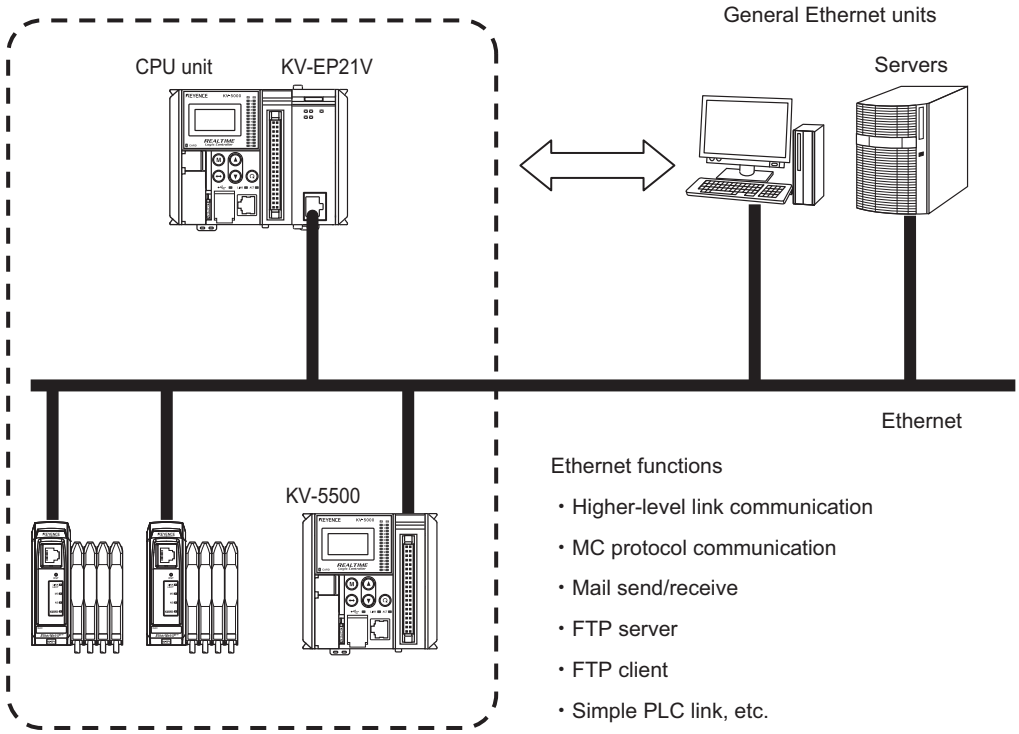
● Multivendor network among EtherNet/IP Devices

Multivendor network among EtherNet/IP Devices can be built.
With EtherNet/IP communication function, controller-level network among scanners and device-level network among scanners and adapters can be built.



● Building network including general Ethernet units

Multivendor network including both EtherNet/IP Devices and general Ethernet units can be built. General Ethernet functions can be used in the same network.



Ethernet functions

- Higher-level link communication
- MC protocol communication
- Mail send/receive
- FTP server
- FTP client
- Simple PLC link, etc.

Overview of EtherNet/IP Unit functions

■ EtherNet/IP communication

Cyclic (I/O) messages and explicit messages with EtherNet/IP Device are available. EtherNet/IP communication function includes the functions of cyclic (I/O) messages, explicit messages (client), explicit messages (server) and node status acquisition.

"Chapter 4 EtherNet/IP COMMUNICATION", page 4-1

■ Sensor application

Using the sensor application allows the parameters of the sensor (adapter) connected to the EtherNet/IP Unit to be backed up or changed, and for the operation status to be monitored easily. Sensor application includes the functions of backup sensor settings, sensor monitor, batch transmission sensor settings and sensor setting command.

"Chapter 7 SENSOR APPLICATION", page 7-1

■ Transfer and monitor of Ladder program

The Ladder program created using KV STUDIO can be transferred and the operation status of EtherNet/IP Units can be monitored.

■ Connection with VT3 Series

Communication with VT3 Series touch panel display via Ethernet is available.

■ Data acquisition software

- **KV COM+for Excel (purchase separately)**

  Excel can be used to easily monitor CPU units, acquire data and replace device values easily.

- **KV COM+Library (purchase separately)**

  Communication with EtherNet/IP Units is available just by embedding Active X into the development environment, such as Visual C and Visual Basic.

■ Communication with host-link equipment

Communication program is not required for communication with host-link equipment.

- **Uplink communication**

  This function allows communication with host-link equipment based on our private communication protocol.

  "Chapter 8 HOST-LINK COMMUNICATION FUNCTION", page 8-1

- **MC protocol communication**

  This function allows communication with equipment supporting MC protocol.

  "Chapter 9 MC PROTOCOL COMMUNICATION FUNCTION", page 9-1

- **FTP server**

  With this function, various files can be read from or written in memory card of CPU unit. In addition, device value of CPU unit can also be read.

  "Chapter 11 FTP SERVER", page 11-1

● FTP client

Any file stored in the memory card or any device value of CPU unit can be uploaded/downloaded to FTP server.

The files generated based on logging/tracing function of CPU unit can be uploaded to FTP server.

"Chapter 12 FTP CLIENT FUNCTION", page 12-1

■ Mail send/receive

With this function, mail can be sent to log-in mail address when preset trigger occurs, or logging/tracing ends. In addition, when receiving command via mail, the command can be executed, and the response can be returned.

"Chapter 10 MAIL SEND/RECEIVE", page 10-1

■ Auto clock data adjustment

Clock data of CPU unit can be adjusted automatically by synchronizing with NTP (SNTP) server.

"Auto Clock Data Adjustment Function", page A-39

■ Simple PLC link

Simple PLC link function enables PLC link of up to 32 settings with simple data communication setting, while Ladder program is not required.

"Chapter 13 SIMPLE PLC LINK FUNCTION", page 13-1

■ BOOTP client

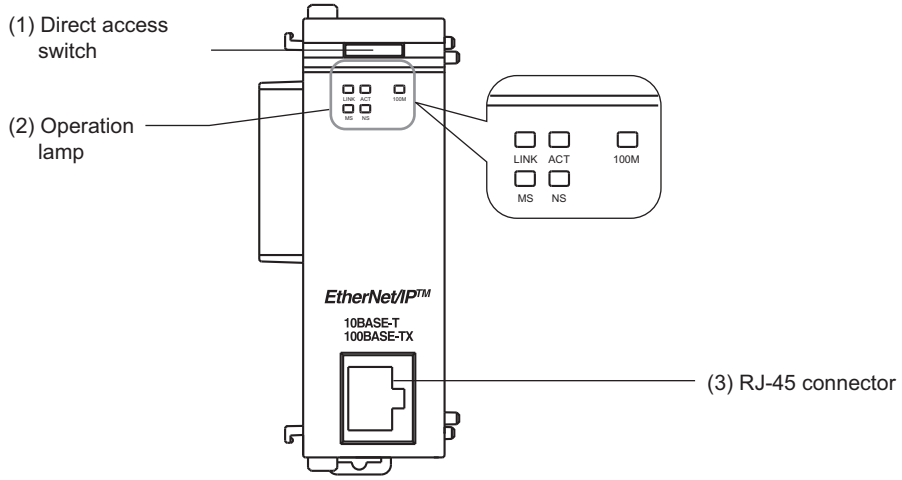
This function enables the set up of EtherNet/IP Unit IP addresses from the KV STUDIO or BOOTP server connected to the network. When using BOOTP client, the IP address setting method can be set to "BOOTP" or "BOOTP -> fixed IP auto switching".

"IP address setting method", page 3-6

"Communication without Unit Setting/BOOTP", page A-5

This section describes the names and functions of the parts of the EtherNet/IP Units KV-EP21V and KV-NC1EP. For part names and functions of the KV-5500, see the "KV-5500/5000/3000 Series User's Manual".

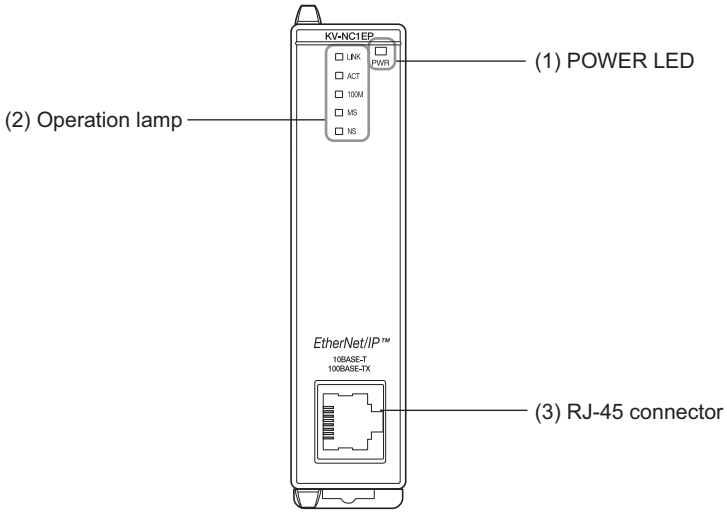
■ For KV-EP21V



No.	Name	Function	
(1)	Direct access switch	Lamp is ON when KV-EP21V is powered ON. The relation of switch color and lamp ON/blinking corresponding to the status is as follows.	
		Green (ON):	Indicating normal operation.
		Green (blinking)	Lamp becomes blinking after pressing the switch in lamp ON status, and the status of KV-EP21V unit is displayed in the access window.
		Red (ON)	Indicating that an error occurs in KV-EP21V.
		Red (blinking)	Lamp becomes blinking after pressing the switch in lamp ON status, and error code is displayed in the access window.
(2)	Operation lamp	LINK (green)	Indicating the link status of target unit. Lamp ON: Link is established.*1 Lamp OFF: Link is not established.
		ACT (green)	Indicating data send/receive status (enabled only at LINK lamp ON). Blinking: Data send/receive in progress OFF: Not send/receive data
		100M (green)	Indicating data transmission rate. Lamp ON: 100Mbps. Lamp OFF: 10Mbps.
		MS (green, red)*2	Indicating the operation status of unit. Green ON: Indicating normal operation. Green blinking: Not execute unit setting Red ON: Fatal error occurs in unit. Red blinking: Clearable error occurs in unit.
		NS (green, red)*2	Indicating the communication status of network. Lamp OFF: IP address not set. Green ON: More than one connection is established. Green blinking: No connection is established. Red ON: IP address duplicated. Red blinking: Time out occurs to more than one connection (tag setting) taking KV-EP21V *3 as target.
(3)	RJ-45 connector	To connect network cable connector (RJ-45 modular connector) (10BASE-T/100BASE-TX).	

*1 Link established means that the communication unit is powered ON, and Ethernet cable is connected correctly.
*2 When powered on (Self test in progress), lamp MS (green, red) and NS (green, red) will be ON in the following sequence: green MS -> red MS -> green NS -> red NS.
*3 The end opening connection is referred to as originator, and the other end to be connected is target.

■ For KV-NC1EP



No.	Name	Function	
(1)	POWER LED	Lights when the KV-NC1EP is turned on.	
		Lamp ON (green)	Powered.
		Lamp OFF	Not powered.
(2)	Operation lamp	LINK (green)	Indicating the link status of target unit. Lamp ON: Link is established.*1 Lamp OFF: Link is not established.
		ACT (green)	Indicating data send/receive status (enabled only at LINK lamp ON). Blinking: Data send/receive in progress OFF: Not send/receive data
		100M (green)	Indicating data transmission rate. Lamp ON: 100Mbps. Lamp OFF: 10Mbps.
		MS (green, red)*2	Indicating the operation status of unit. Green ON: Indicating normal operation. Green blinking: Not execute unit setting Red ON: Fatal error occurs in unit. Red blinking: Clearable error occurs in unit.
		NS (green, red)*2	Indicating the communication status of network. Lamp OFF: IP address not set. Green ON: More than one connection is established. Green blinking: No connection is established. Red ON: IP address duplicated. Red blinking: Time out occurs to more than one connection (tag setting) taking KV-NC1EP *3 as target.
(3)	RJ-45 connector	To connect network cable connector (RJ-45 modular connector) (10BASE-T/ 100BASE-TX).	

*1 Link established means that the communication unit is powered ON, and Ethernet cable is connected correctly.
*2 When powered on (Self test in progress), lamp MS (green, red) and NS (green, red) will be ON in the following sequence: green MS -> red MS -> green NS -> red NS.
*3 The end opening connection is referred to as originator, and the other end to be connected is target.

1-3 Specifications

The following tables show the general specifications, transmission specifications, and performance specifications of the KV-EP21V and KV-NC1EP EtherNet/IP Units.
For general specifications of the KV-5500, see the "KV-5500/5000/3000 Series User's Manual".

■ General specifications (KV-EP21V)

Item	Specifications				
Model	KV-EP21V				
Supply voltage	24V DC (± 10%)				
Current consumption	Below 100mA				
Operating ambient temperature	0 to +50°C (no freezing)*1, *2				
Storage ambient temperature	-20 to +70°C*1				
Operating ambient humidity	10 to 95% RH (no condensation)*1				
Storage ambient humidity	10 to 95% RH (no condensation)*1				
Withstand voltage	AC 1500V, 1 min (between power terminal and I/O terminals, and between all external terminals and case)				
Noise immunity *3	Above1500Vp-p, pulse width 1μs, 50ns (by noise simulator)				
Vibration resistance	Comply with JIS B 3502 IEC61131-2	Intermittent vibration			Scan times
		Frequency	Acceleration	Half amplitude	10 times in X/Y/Z direction respectively (100 min)
		5-9Hz	-	3.5mm	
		9-150Hz	9.8m/s^2	-	
		Continuous vibration			
		Frequency	Acceleration	Half amplitude	
		5-9Hz	-	1.75mm	
		9-150Hz	4.9m/s^2	-	
Shock resistance	Acceleration150m/s^2, working time 11ms, 2 cycles in X, Y, Z direction respectively				
Insulation resistance	Above 50 MΩ (between power terminal and I/O terminals, and between all external terminals and case, by 500VDC megger)				
Operation environment	Less dust and corrosive gases				
Altitude	Below 2,000m				
Over voltage category	II (when using KV-U7)				
Degree of pollution	2				
Weight	approx. 120g				
Dimension	90mm(H)×29mm(W)×80mm(D)				
Supported CPU unit	CPU unit with CPU function version 2 or above (KV-5500/5000/3000)				

*1 Guarantee range as a system.
*2 The temperature at unit lower in control panel.
*3 📖 In case noise filter (page 2-15) for DC power supply is not equipped.

■ General specifications (KV-NC1EP)

Item	Specifications				
Model	KV-NC1EP				
Supply voltage	DC 24 V (+10%/-15%)				
Current consumption	Below 90mA				
Operating ambient temperature	0 to +55°C (no freezing)*1, *2				
Storage ambient temperature	-20 to +70°C*1				
Operating ambient humidity	5 to 95% RH (no condensation)*1				
Withstand voltage	AC 1500V, 1 min (between power terminal and I/O terminals, and between all external terminals and case)				
Noise immunity *3	Above1500Vp-p, pulse width 1μs, 50ns (by noise simulator)				
Vibration resistance	Comply with JIS B 3502 IEC61131-2	Intermittent vibration			Scan times
		Frequency	Acceleration	Half amplitude	10 times in X/Y/Z direction respectively (100 min)
		5-9Hz	-	3.5mm	
		9-150Hz	9.8m/s^2	-	
		Continuous vibration			
		Frequency	Acceleration	Half amplitude	
		5-9Hz	-	1.75mm	
		9-150Hz	4.9m/s^2	-	
Shock resistance	Acceleration150m/s^2, working time 11ms, 3 cycles in X, Y, Z direction respectively				
Insulation resistance	Above 50 MΩ (between power terminal and I/O terminals, and between all external terminals and case, by 500VDC megger)				
Operation environment	Less dust and corrosive gases				
Altitude	Below 2,000m				
Over voltage category	I				
Degree of pollution	2				
Weight	approx. 110g				
Supported CPU unit	KV Nano Series base unit with CPU function version 2 or later (KV-N24**, KV-N40**, KV-N60** and KV-NC32T)				

*1 Guarantee range as a system.
*2 The temperature at unit lower in control panel.
*3 📖 In case noise filter (page 2-15) for DC power supply is not equipped

■ Transmission mode (common)

Item	Specifications	
	10BASE-T	100BASE-TX
Transmission rate	10Mbps	100Mbps
Transmission media	STP or UTP (Category 3 or above)*1	STP or UTP (Category 5 or above)*1
Max. cable length*2	100m	100m
Max. number of connected segments of HUB*3	4	2

Complies with IEEE802.3.

*1 STP = Shielded Twisted Pair, UTP = Unshielded Twisted Pair
*2 The max. cable length is the distance between the EtherNet/IP Unit (KV-EP21V, KV-5500 or KV-NC1EP) and the HUB.
*3 There is no restriction on the number of connected segments in case of using an Ethernet switch.

■ EtherNet/IP communication specifications (common)

Item				KV-EP21V	KV-5500	KV-NC1EP
CIP Service	Cyclic (I/O) messages	Number of connections		256*1		64*7
		RPI (communication period)		0.5 to 10000ms (increment: 0.5ms) Set up each connection. (Irrelevant to number of nodes, update data on the line according to the set period)		
		Send trigger	Output to adapter	Cyclic		
			Input from adapter	Cyclic / Change of state*2		
		Allowable communication bandwidth of cyclic (I/O) messages	(@504Byte)	12000(pps)*3	10000(pps)*3	6000(pps)*3
			(@1444Byte)	6000(pps)*3	5000(pps)*3	3000(pps)*3
		Max. number of refresh words		24k words	16k words	8k words
		Max. data size per connection *4		504 bytes or 1444 bytes		
		Multicast packet filter function*5		Available (IGMP client function)		
	Explicit messages	Class3 (Connection type)	Server	Number of connections: 256*6		Number of connections: 64*8
		UCMM (Non-connection type)	Client	Tasks executed simultaneously: 32		
			Server	Tasks executed simultaneously: 96		
EtherNet/IP conformance test				Comply with A7		Comply with CT10

*1 The maximum number of connections used in explicit messages of Class3 (connection type) is 256 (64).

*2 Communication with the unit outputting data in the form of change of state (send data in case of change) is available. EtherNet/IP Units (KV-EP21V, KV-5500 and KV-NC1EP) cannot output data in the form of change of state.

*3 The abbreviation of Packet Per Second, which represents the number of sent/received data packets processed in one second.

*4 Simultaneity of data in the connection is ensured. In case of more than 505 bytes, the unit must support Large Forward Open (CIP option).

*5 As EtherNet/IP Units (KV-EP21V, KV-5500 and KV-NC1EP) have IGMP Client functions, unnecessary multicast packets can be filtered using a Ethernet Switch compliant with IGMP Snooping.

*6 The maximum number of connections used in cyclic (I/O) messages is 256 (64).

*7 If KV-NC1EP is connected to from an originator using cyclic communication multicast, more than 64 connections may be made. However, KV-NC1EP is guaranteed to work for up to a maximum of 64 connections.

*8 The total number of connections which can be used with the cyclic communication function is 64. Even if over 64 connections are made, the KV-NC1EP is only guaranteed to work with up to 64 connections.

■ Performance specifications (common)

Function	Number of sockets		Port No.
	TCP	UDP	
PC application[*1]	8	0	8500 (setting range: 1 to 65535)
Higher-level link communication[*2*3]	Total 15	1	8501 (setting range: 1 to 65535)
MC protocol communication[*2*3]		1	5000 (setting range: 1 to 65535)[*4]
VT3 connection	0	1	8502 (setting range: 1 to 65535)
FTP server	4	-	20, 21
Auto clock data adjustment	-	1	123
Mail send/receive (SMTP, POP3)	2	-	25, 110
DNS	-	1	53
FTP client	2	-	20, 21 (setting range: 1 to 65535)
Simple PLC link	-	1	5001 (setting range: 1 to 65535)
EtherNet/IP cyclic (I/O) messages	Total 320	1	2222
EtherNet/IP explicit messages		1	44818

*1 KV STUDIO, KV COM+ or DATA BUILDER

*2 TCP socket and UDP socket can be used simultaneously.

*3 15 TCP sockets can be used at most.

*4 Port No. can be set separately for TCP socket and UDP socket.

Point

When a KV-EP21V is connected to KV-5500/5000/3000, since port 8503, 8504, 8505 and 8506 are reserved for system in any operating mode, they cannot be used for all functions.

However, for port 8504 and 8506, port No. (system extension) and port No. (system extension 2) of Unit Editor can be set to any No..

MEMO

2

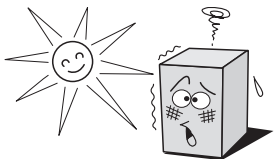
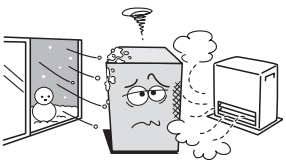
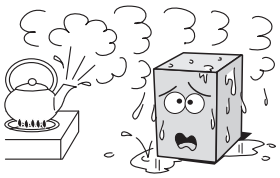
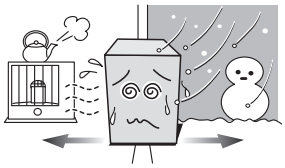
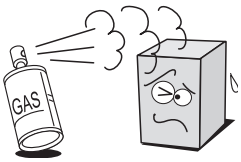
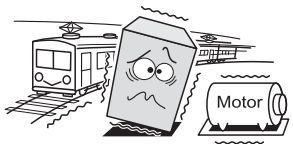
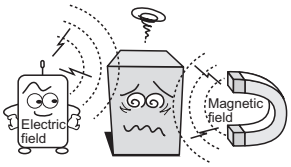
UNIT INSTALLATION

This chapter describes the installation environment of the KV-5500 EtherNet/IP function, KV-EP21V and KV-NC1EP, as well as how to install it on the CPU unit, and how to connect it to the Ethernet.

2-1 Check Installation Environment 2-2
2-2 Installing on CPU Units (base unit) 2-3
2-3 Connecting to Ethernet. 2-8
2-4 Maintenance and Service. 2-16

2-1 Check Installation Environment

Don't install units in the following locations:

Location under direct sunshine	Location with ambient temperature beyond the range of 0 to +50°C*1	Location with ambient humidity beyond the range of 10 to 95% RH*2
		
Location where condensation may occur due to sharp temperature change	**Location where corrosive gases or inflammable gases exist**	**Location where heavy dust, salt, iron chip, or oil smoke exist**
		
Location subject to direct vibration or shock	**Location where water, oil, or chemicals is sprayed**	**Location where strong magnetic or electric field exists**
		

- Location where elevation is above 2000m

*1 0 to 55°C for KV-NC1EP.

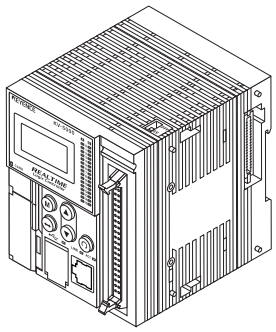
*2 5 to 95% RH for KV-NC1EP.

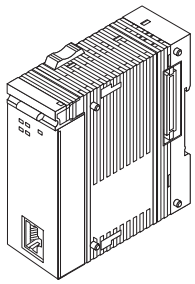
2-2 Installing on CPU Units (base unit)

■ When installing KV-EP21V

This section describes the procedures for installing EtherNet/IP Device KV-EP21V on the CPU unit.

CPU unit





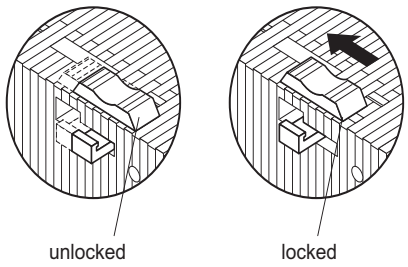
KV-EP21V

Point

Please perform installation with power OFF.

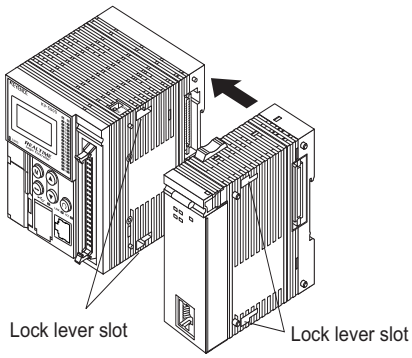
1 **Unlock the lock levers at the top and bottom of the right unit.**

- Press down the notch by the finger, slide toward the front of the unit to remove it.



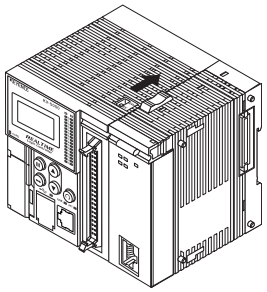
2 **Insert the lock lever of KV-EP21V into the lock lever slot of the left CPU unit to connect.**

- Keep two units in parallel, and align connectors to complete connection easily.



3 **Slide the lock levers at the top and bottom of the right unit to lock.**

- Same as step 1, press down the notch by the finger and slide toward the back of the unit.
- At this moment, you must check whether any gap exist between units. If there is any gap, the connection is not right.

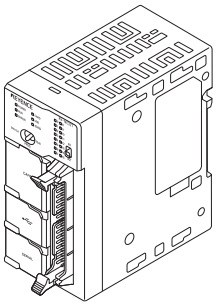


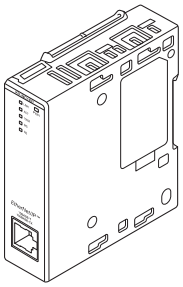
■ When installing KV-NC1EP

This installation procedure describes how to install the KV-NC1EP EtherNet/IP Unit onto the base unit.

● For the KV-NC32T connector type base unit

KV-NC32T
(left side)



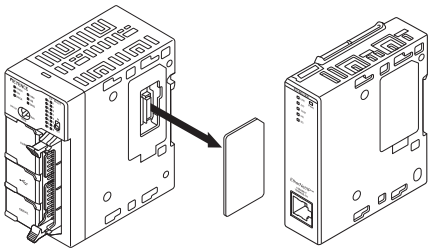


KV-NC1EP
(right side)

Point

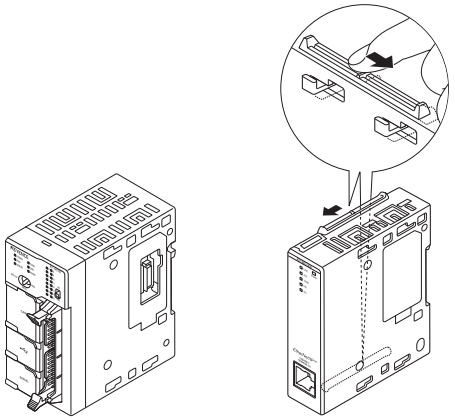
Be sure to turn the power off when mounting the unit.

1 **Remove the expansion unit connection connector cover (right side) of the unit on the left side.**



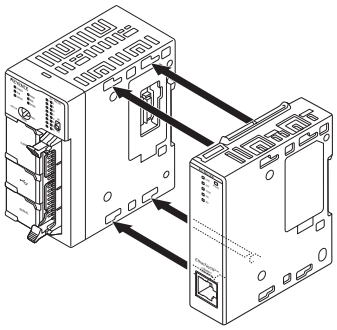
2 **Release the lock levers attached to the top and bottom of the right unit.**

• Put your finger on the depression and slide it towards the front of the unit to release it.



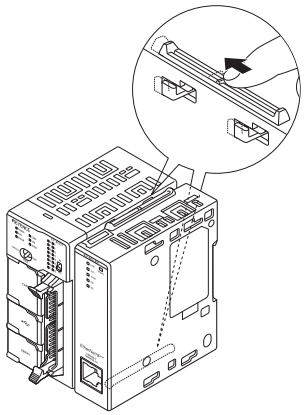
3 **Insert the right unit's lock lever into the lock lever slot on the left unit.**

• They can be easily connected by holding them parallel and aligning the positions of the connectors.

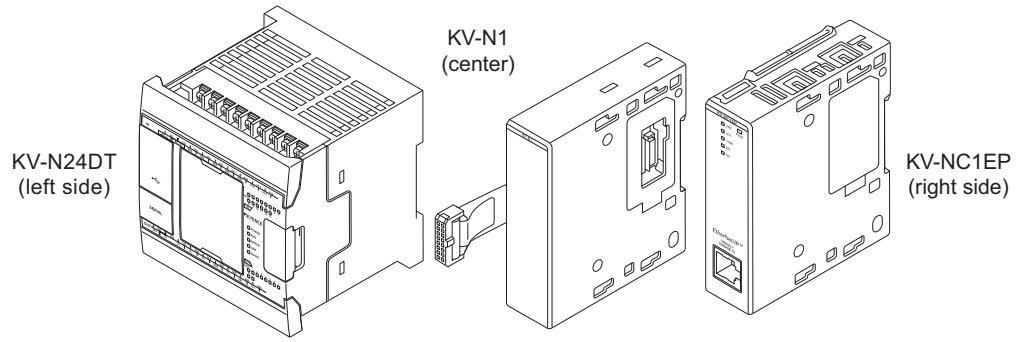


4 **Lock the lock levers attached on the top and bottom of the right unit.**

• Perform the reverse of step 2 by putting your finger on the depression and sliding it towards the back of the unit. Check that there is not a gap between the units. If there is a gap, they are not properly connected.



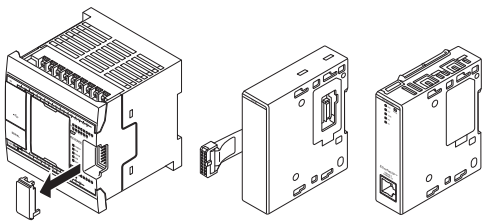
● For the KV-N24DT terminal block type base unit



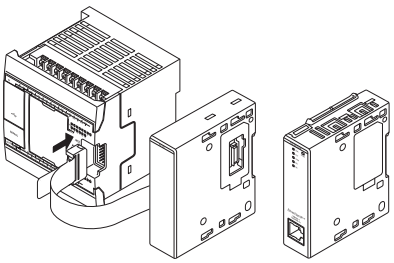
Point

Be sure to turn the power off when mounting the unit.

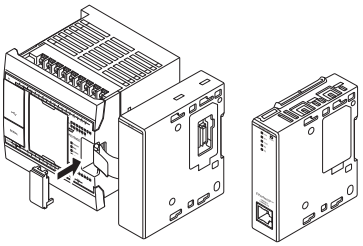
1 **Remove the expansion unit connection connector cover of the unit on the left side.**



2 **Insert the connector cable that is coming out of the left side of the connection conversion unit into the expansion unit connection connector.**

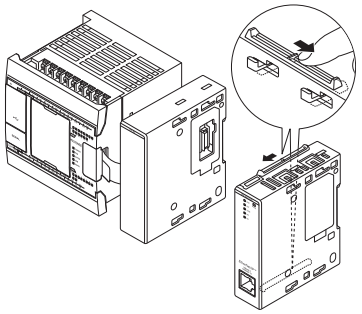


3 **Reattach the cover removed in step 1.**



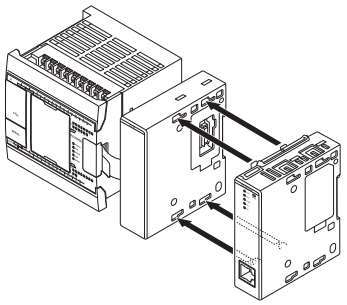
4 **Release the lock levers attached to the top and bottom of the right unit**

- Put your finger on the depression and slide it towards the front of the unit to release it.



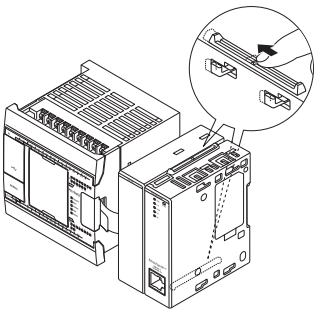
5 **Insert the right unit's lock lever into the lock lever slot on the left unit.**

- They can be easily connected by holding them parallel and aligning the positions of the connectors.



6 **Lock the lock levers attached on the top and bottom of the right unit.**

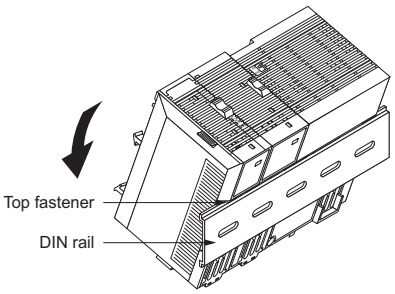
- Perform the reverse of step 2 by putting your finger on the depression and sliding it towards the back of the unit. Check that there is not a gap between the units. If there is a gap, they are not properly connected.



Installing on a DIN rail

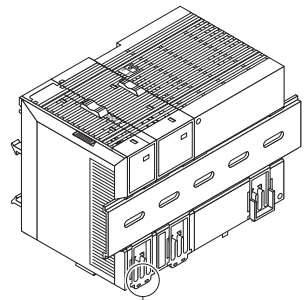
■ Installation

1 **Hang the groove at the upper of DIN rail onto the DIN rail installing claws at the upper of each unit.**



2 **Fix the lower part of DIN rail to the DIN rail installing claws at the lower of each unit.**

- The lower black claw can move under action of spring. Press it down until "clicks" is heard.
- Where it is inconvenient to install, please remove all locks firstly, and then lock after installing onto DIN rail.

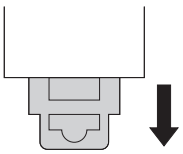


3 **Check to ensure the DIN rail installing claws at the lower is inserted (locked).**

■ Removal

1 **Pull out the lower DIN rail installing claw.**

2 **Remove the DIN rail from the unit in reverse order as installation.**



Point

When reinstalling the unit after removing it from the DIN rail, press the lower DIN rail installing claws.

2-3 Connecting to Ethernet

The following describes the procedure for connecting EtherNet/IP Units to the Ethernet.

Applicable cable

The cables used for connecting EtherNet/IP Units to the Ethernet are as follows. Cables used for building 10BASE-T Ethernet and 100BASE-TX Ethernet are different.

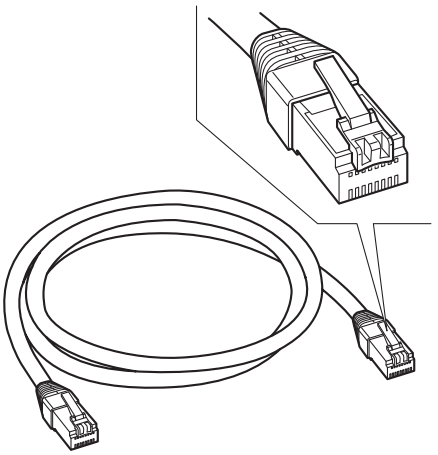
For 10BASE-T Ethernet

Shielded twisted pair (STP) or unshielded twisted pair (UTP) of category 3 or above should be used in case of building 10BASE-T Ethernet.

For 100BASE-TX Ethernet

STP or UTP of category 5 should be used in case of building 100BASE-TX Ethernet. Do not use Category 3 or 4 UTP cable.

STP/UTP cable



Point

- **STP/UTP straight-through cables should be used when connecting EtherNet/IP Units and the HUB.**
  Do not misuse STP/UTP crossover cable and STP/UTP straight-through cable since they are similar in appearance.
- **STP cable must be used if there is noise in installation environment.**

Reference

- STP/UTP crossover cables should be used when directly connecting EtherNet/IP Units and PCs.
- HUB with AUI (MAU) connector or BNC connector, or media converter (10BASE5 -> 10BASE-T and 10BASE2 -> 10BASE-T) should be used in case of building Ethernet (10BASE-2, 10BASE-5 etc) other than 10BASE-T or 100BASE-TX.

Ethernet Switch Used

Point

When executing cyclic (I/O) messages of EtherNet/IP communication, 100Mbps (full duplex) Ethernet switch should be used instead of repeater hub. Cyclic (I/O) messages means high-speed and large-capacity data communication. If hub repeater is used, data collision may occur and stable communication is unavailable.

In addition, Ethernet switch can avoid loop connection and broadcast storm, in this way, sometimes the setting-restricted communication bandwidth can be enabled. Please check Ethernet switch setting carefully and adopt setting with a bandwidth as wide as possible against actual bandwidth used.

"Check communication load", page 2-11

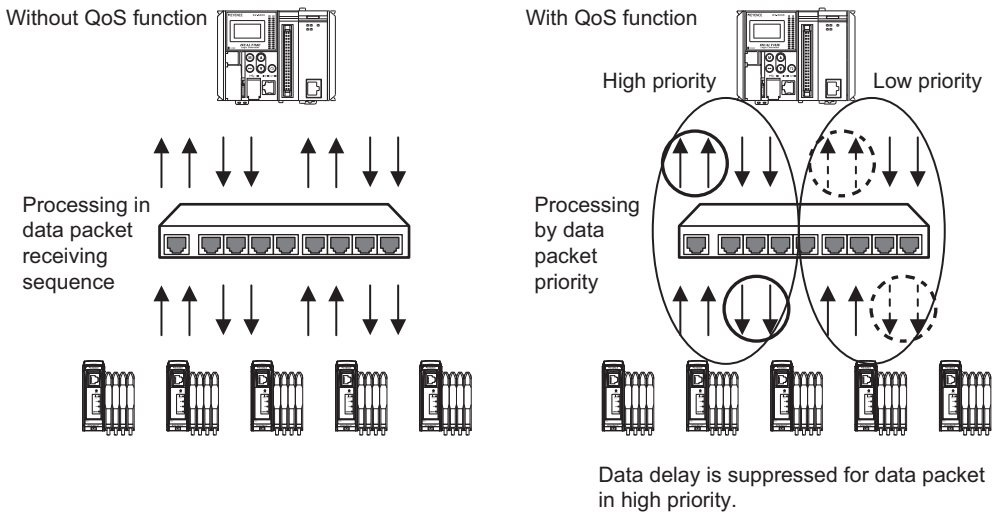
■ Selection of Ethernet switch

When executing EtherNet/IP cyclic (I/O) messages, please use the Ethernet switch with the following functions according to usage.

Function		Selection of Ethernet switch	
		QoS(L4) function	Multicast packet filter function
Disable cyclic (I/O) messages		–	–
Enable cyclic (I/O) messages	Disable multicast	○	–
	Enable multicast	○	○

● QoS(L4) function

Ethernet switch with QoS (Quality of Service) function enables to send date packets based on their priority rather than on the receiving sequence. The data given high priority will be first processed, therefore even if under large communication load, the preferred communication will not be delayed, so as to ensure stable data send/receive. For QoS (L4), priority can be set up for the used port No.



Settings of Ethernet switch

Please set the port No. of UDP to 2222 when raising the priority of EtherNet/IP cyclic (I/O) messages.

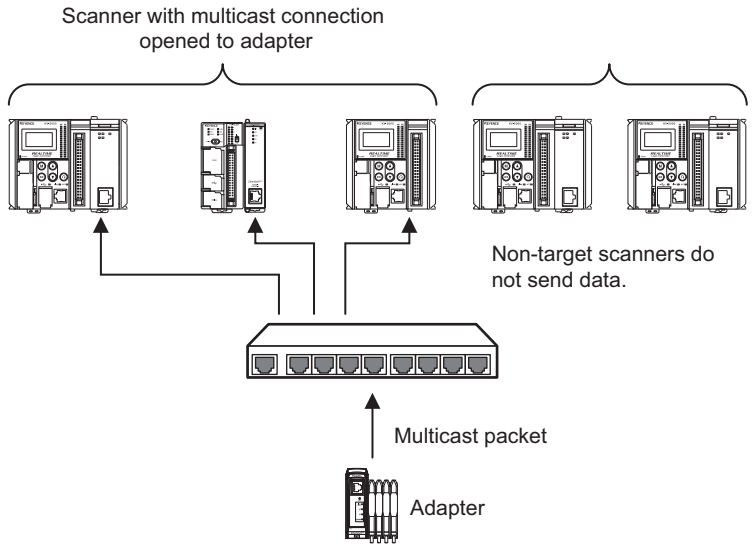
Reference

Port No. 2222 is used for EtherNet/IP cyclic (I/O) messages.
For TCP/UDP port No. used for EtherNet/IP Unit functions, see
"Performance specifications (common)", page 1-11.

● Multicast packet filter function

If multicast packet filter is set in the Ethernet switch, the multicast packet received from EtherNet/IP can only be sent to target scanner. If this function is unavailable, the multicast packet will be sent to all units, thus increasing load of communication lines.

IGMP snooping function is available in Ethernet switch with multicast packet filter. IGMP Snooping function is used for detecting the units responding to the IGMP query sent from Ethernet switch or router. After the multicast packet is sent to the network, the Ethernet switch only sends the multicast packet to the detected units. When the multicast connection opens, EtherNet/IP Units with IGMP clients will respond to IGMP queries.



Settings of Ethernet switch

The number of multicast packet filters should be larger than the number of multicast addresses.

Reference

EtherNet/IP Units can send IGMP queries. When the Ethernet switch or the router in the network fails to send IGMP queries, please set the "Enable IGMP query send" in Unit Editor to "Enable". EtherNet/IP Units will send IGMP queries regularly. Some Ethernet switch will send all multicast packets to the units sending IGMP queries.
"Enable IGMP query send", page 3-13

■ Check communication load

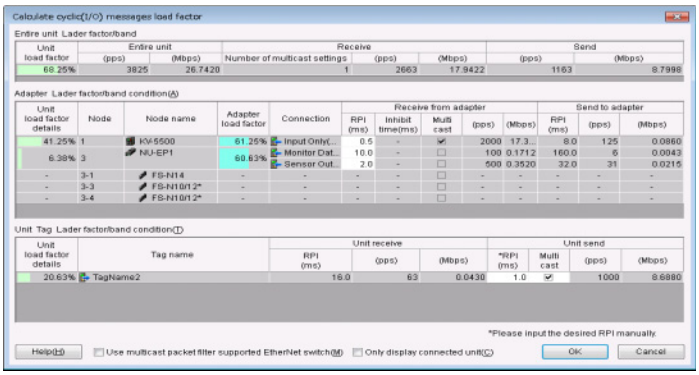
When EtherNet/IP Units are used, the communication load during design or operation can be checked. Please use this function when selecting an Ethernet switch or adjusting the communication rate.

● Check cyclic (I/O) messages load factor during design

• "Calculate cyclic (I/O) messages load factor" dialog box (EtherNet/IP Setting)

The communication load factor of unit (KV-EP21V) and adapters is calculated on the basis of cyclic (I/O) messages setting.

It will be displayed in red if the load factor exceeds 100%.

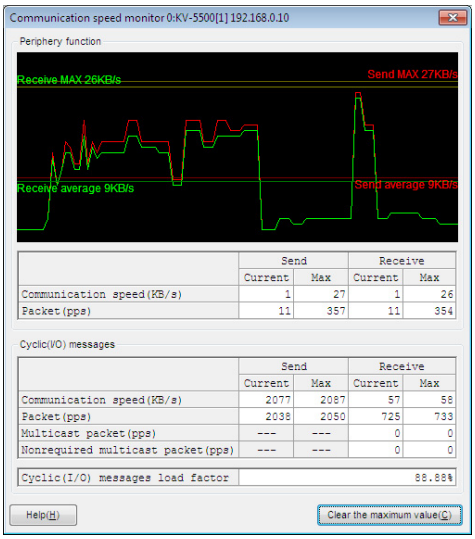


"5-13 Calculate Cyclic (I/O) Messages Load Factor", page 5-67

● Check communication load during operation

• "Communication speed monitor" dialog box (Unit Monitor of KV STUDIO)

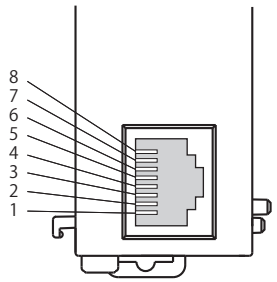
Communication speed of peripheral functions (other than cyclic (I/O) messages), such as simple PLC link and explicit messages, as well as operation speed of cyclic (I/O) messages are displayed in this dialog box.



"Communication speed monitor", page 15-5

Connector for EtherNet/IP Units

The connector for EtherNet/IP Units is a RJ-45 8-pin modular connector (in accordance to ISO 8877) applicable to 10BASE-T and 100BASE-TX, with specifications compliant with IEEE802.3.
Signal assignment of RJ-45 modular connector is shown below.



RJ-45 modular connector

Pin No.	MDI signal	Signal function
1	TD+	Send data (+)
2	TD-	Send data (-)
3	RD+	Receive data (+)
4	-	-
5	-	-
6	RD-	Receive data (-)
7	-	-
8	-	-

Precautions on connecting STP/UTP cable to connector

Do not place any strain on the connector when connecting the STP/UTP cable to EtherNet/IP Units.

Point

Cables may be bent when installing or laying cables. Excessively bending the cables, however, may cause wires inside the cable to break after being used for a long time.
These must be taken into consideration when installing or laying cables.

Connecting EtherNet/IP Units to the Ethernet

The following describes the procedures for connecting EtherNet/IP Units to the Ethernet.

1 **Turn off PLC.**

2 **Connect the modular plug on one end of the STP/UTP cable to the 10BASE-T/100BASE-TX port of the Ethernet switch used.**

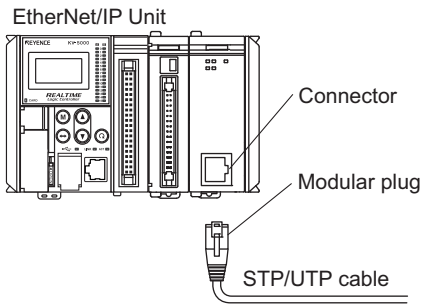
Insert the modular plug until "click" is heard. The modular plug and connector is now locked in place.

Point

- **The length of STP/UTP cable used should not be longer than 100m.**
- **When connecting EtherNet/IP Units to a HUB, please thoroughly check the status of the Ethernet switch connector (port) before connection. Various connectors are available in Ethernet switch, such as connectors different in shape from RJ-45 (AUI connector, BNC connector, etc), and connectors (hereinafter referred to as "cascade port") used for connecting two Ethernet switches.**

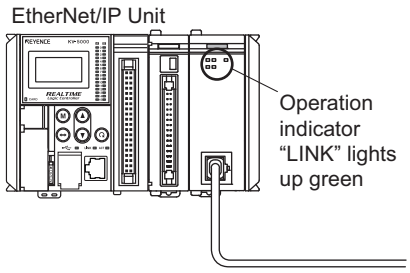
3 **Connect the modular plug on the other end of the STP/UTP cable to the EtherNet/IP Unit connector.**

Insert the modular plug until "click" is heard. The modular plug and connector are now locked in place.



4 **Turn the PLC on, and check whether the "EtherNet/IP Unit LINK" operation lamp illuminates in green.**

It may take about 3 seconds until the lamp illuminates.

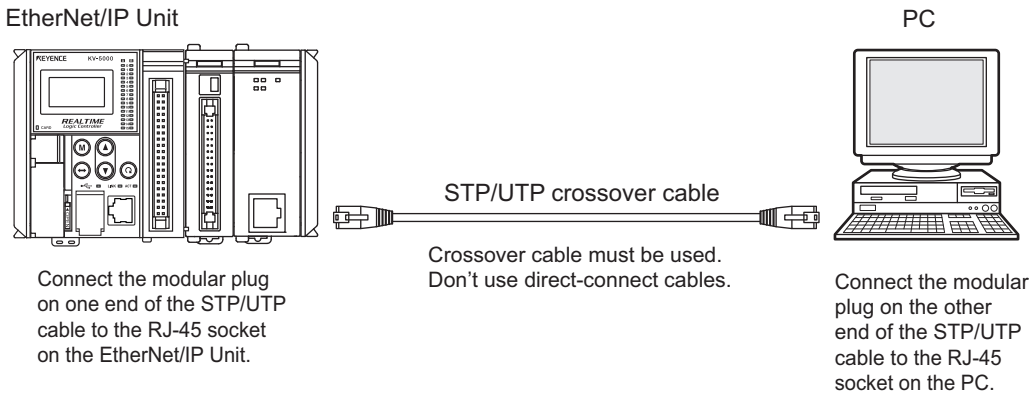


Direct Connection between EtherNet/IP Unit and PC

EtherNet/IP Units operate as units in the Ethernet after being connected to the Ethernet switch. However, connection status may be poor when connecting to the Ethernet.

In this case, you can directly connect the EtherNet/IP Unit to a PC to pin-point whether the fault is a result of the communication environment (Ethernet switch, cable etc.) or terminal units (EtherNet/IP Unit or PC).

The configuration and required devices for direct EtherNet/IP Unit and PC connection are shown below.



Precautions on Building Ethernet

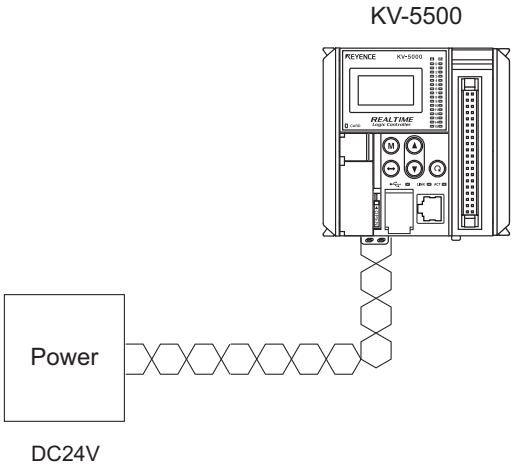
The following describes the precautions to be taken when building an Ethernet onto terminals of PLCs, including EtherNet/IP Units, or PCs.

■ Grounding (installation)

When supplying power to PLC via KV-U7 AC power unit, please perform wiring to KV-U7AC power unit according to description in "AC Power Unit" of 📖 KV-5500/5000/3000 Series User's Manual.

■ Precautions on using a DC power supply

Wire as follows when using a DC power supply.



■ Noise protection

As a noise protection measure, LAN cable should be kept an appropriate distance away from the noise source in the Ethernet environment involving both of them. If noise source is close to LAN cables, communication errors may occur, or throughput may drop.

A lightning protector with surge current suppression and noise elimination functions should be installed when using units in an environment where no lightning protection measure is taken. Also, appreciate grounding must be ensured.

When it fails to reduce noise, a ferrite core should be installed on the communication lines, or optical cables should be used.

■ Power interruption countermeasures

When using the units in a environment where no power interruption measure is taken, an uninterruptible power supply (UPS) should be installed on Ethernet to prevent loss of data and adverse influence on the system.

2-4 Maintenance and Service

This section describes how to maintain and repair the unit.

■ Inspection

When units are used for a long time, the connecting part of connectors may become loose. Operation failure may occur if it is used continuously in this status.
For this reason, regular inspection must be performed for the unit and wired parts.

The main inspection items are as follows:

- Check the locking piece at each unit's connection part for disconnection or looseness.
- Check the connector's connection part for disconnection or looseness.
- Check the screws on the communication terminals for looseness.
- Check the wiring cables between units and other equipment for damage.

■ Maintenance

Dirt adheres on the units when they are used for a long time.
Clean off any dirt on the unit using a clean and dry cloth.
Dust and dirt on fine parts, such as connectors, can be removed with a cotton bud after removing the connector.
Be sure to turn off the power before performing maintenance and inspection on the unit.

NOTICE	**Be sure to turn off the power before performing maintenance and inspection on the unit.**

3

UNIT SETTING

This chapter describes the unit setting of EtherNet/IP Units.

3-1 Unit Editor Setting 3-2
3-2 Set up Individual Items 3-6

3-1 Unit Editor Setting

This section describes Unit Editor and lists its setting items.

What is Unit Editor

Unit Editor is software included in the Ladder Support Software KV STUDIO. It is used to set up PLC unit configuration, and EtherNet/IP Unit communication functions. This setup must be performed the first time that the EtherNet/IP Unit is used.

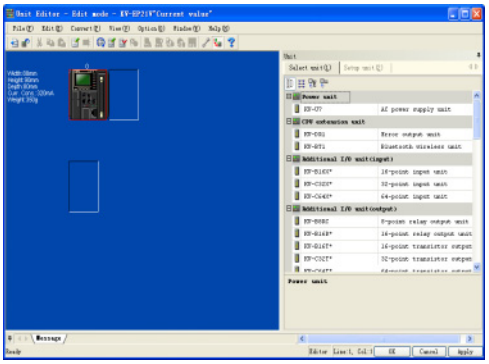
For how to start up and use Unit Editor, see KV STUDIO User's Manual.

How to Set Up Using Unit Editor

The following describes the procedure for setting up the KV-EP21V unit using Unit Editor.

1 Start up KV STUDIO (Ver.6 or above) first, and then start up Unit Editor.

Select "Tool" ► "Unit Editor" from the menu of KV STUDIO.



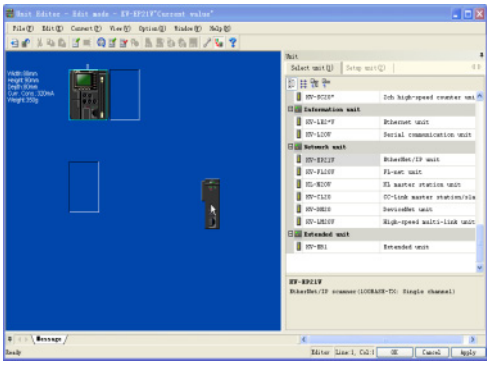
Other procedure

- Click button.

For details, see KV STUDIO User's Manual.

2 Select the unit to be connected in "Select Unit (1)" tab and connect it to CPU unit by dragging & dropping.

For details, see KV STUDIO User's Manual.



3 **Set up KV-EP21V in detail in the unit configuration area.**

Select "KV-EP21V" and double click it. KV-EP21V setting will be displayed in the unit setting window.

Other procedure

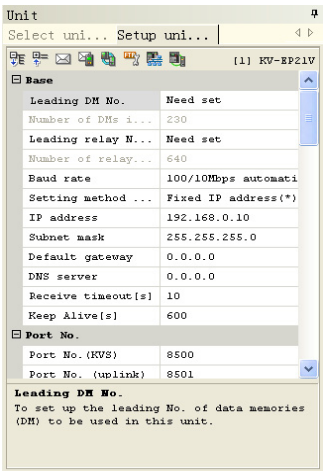
- Press "↵" key

4 **Click the item for which the setting is to be changed and enter the set value.**

- To enter from text box

  Enter the values in the displayed text box.
- To enter from dropdown list

  Select the items from the displayed dropdown list.



5 **Press "↵" key.**

The settings are confirmed.

6 **Set up all connected units following the steps 3 to 5.**

7 **Select "File" ▶ "Close" from the menu. This saves the system created, and returns to the Editor.**

Other procedure

- Click " " button.
- Click " OK " button.

Setting Item List

The function details of EtherNet/IP Unit are set up in Unit Editor. The following table lists the items to be set up in Unit Editor, and their respective setting ranges and defaults.

Item	Setting range	Default value	See page
"Basic"			
Leading DM No.	0 to 65304	To be set	3-6
Leading relay No. (set up by channel)	10 to 960	To be set	3-6
Communication rate	"100/10Mbps Auto"/"10Mbps"	100/10Mbps Auto	3-6
IP address setting method	Fixed IP address/BOOTP/ Fixed IP Auto switching/BOOTP	Fixed IP address	3-6
IP address	(0 to 255).(0 to 255).(0 to 255).(0 to 255)	192.168.0.10	3-7
Subnet mask	(0 to 255).(0 to 255).(0 to 255).(0 to 255)	255.255.255.0	3-7
Default gateway*1	(0 to 255).(0 to 255).(0 to 255).(0 to 255)	0.0.0.0	3-7
DNS server*1	(0 to 255).(0 to 255).(0 to 255).(0 to 255)	0.0.0.0	3-8
Receive time out [s]	10 to 59	10	3-8
Keep-Alive [s] *1	0 to 65535	600	3-8
<Port No.>			
Port No. (KVS)	1 to 65535 (1024 to 65535 recommended)	8500	3-8
Port No. (host-link)	1 to 65535 (1024 to 65535 recommended)	8501	3-8
Port No. (VT)	1 to 65535 (1024 to 65535 recommended)	8502	3-9
Port No. (system extension)	1 to 65535 (1024 to 65535 recommended)	8504	3-9
Port No. (system extension 2)	1 to 65535 (1024 to 65535 recommended)	8506	3-9
Simple PLC link port No. (UDP)	1 to 65535 (1024 to 65535 recommended)	5001	3-9
MC protocol port No. (TCP)	1 to 65535 (1024 to 65535 recommended)	5000	3-9
MC protocol port No. (UDP)	1 to 65535 (1024 to 65535 recommended)	5000	3-9
<Routing setting>			
Routing setting	Disable/Enable	Disable	3-10
Target IP address *1	(0 to 255).(0 to 255).(0 to 255).(0 to 255)	0.0.0.0	3-10
Target subnet mask*1	(0 to 255).(0 to 255).(0 to 255).(0 to 255)	0.0.0.0	3-10
Router IP address*1	(0 to 255).(0 to 255).(0 to 255).(0 to 255)	0.0.0.0	3-10
<EtherNet/IP setting>			
Auto assignment setting	Disable/Enable	Enable	3-11
Assign bit device leading No.	R1000 to 99900*3, B000 to 3FF0*4 DM0 to 65534*5, W0000 to 3FFE	B000	3-11
Assign word device leading No.	DM0 to 65534*5, W0000 to 3FFE	W0000	3-11
Upper limit of refresh (word/scan)	0 to 65535	252	3-11
Auto start cyclic (I/O) messages	Enable/Disable	Enable	3-11
Cyclic (I/O) messages error detection Mask time (connection) [s]	1 to 120	60	3-12
Cyclic (I/O) messages error detection Mask time (disconnection) [s]	1 to 120	5	3-12
Explicit messages time out [ms]	10 to 65530	10000	3-12
Retry time (system extension) [s]	0 to 65535	60	3-12
TTL for multicast	1 to 255	1	3-12

Item	Setting range	Default value	See page
Multicast address specifying mode	Auto assignment/specified by user	Auto assignment	3-12
Number of multicast addresses	1 to 256	256	3-13
Leading multicast address	(224 to 239).(0 to 255).(0 to 255).(0 to 255)	239.255.0.0	3-13
Enable IGMP query send	Disable/Enable	Disable	3-13
IGMP query send interval [s]	1 to 18000	60	3-13
EtherNet/IP setting	<Setting>	-	3-13
<FTP client setting>			
FTP client setting	<Setting>	-	3-13
<FTP server setting>			
Enable FTP server	Disable/Enable	Disable	3-14
Password	Up to 8 half-width alphanumeric characters	[Not set]	3-14
FTP server RUN/PROG switching	Available/Unavailable	Available	3-14
<Simple PLC link setting>			
Simple PLC link setting	<Setting>	-	3-14
<MC protocol communication>			
MC protocol communication code	Binary/ASCII	Binary	3-15
MC protocol name code	0000 to FFFF(H)	0033(H): When KV-3000 is used 0034(H): When KV-5000 is used 0035(H): When KV-5500 is used 0080(H): When KV-NC32T is used 0084(H): When KV-N60** is used 0085(H): When KV-N40** is used 0086(H): When KV-N24** is used	3-15
MC protocol name	Up to 16 characters in ASCII character string	V3000: When KV-3000 is used V5000: When KV-5000 is used V5500: When KV-5500 is used KV-NC32: When KV-NC32T is used KV-N60: When KV-N60** is used KV-N40: When KV-N40** is used KV-N24: When KV-N24** is used	3-15
<Mail setting>			
Mail setting	<Setting>	-	3-15
<Auto clock data adjustment function>			
Auto clock adjustment	Not use/specify time/specify interval	Not use	3-15
SNTP communication time out [ms]	10 to 65000	60	3-15
Clock adjustment time [h]	0 to 23	0	3-16
Clock adjustment time [m]	0 to 59	0	3-16
Clock adjustment time [s]	0 to 59	0	3-16
Clock adjustment interval [m]	1 to 65000	60	3-16
GMT offset	+/-	+	3-16
GMT offset [h]	0 to 23	9	3-16
GMT offset [m]	0 to 59	0	3-16
GMT offset [s]	0 to 59	0	3-16
NTP (SNTP) server*2*3	(0 to 255).(0 to 255).(0 to 255).(0 to 255)	0.0.0.0	3-16

*1 It is disabled if set to 0 or 0.0.0.0.
*2 When DNS server is used, it can be specified according to the HOST name format.
*3 R1000 to 59900 for KV-NC1EP.
*4 B000 to 1FF0 for KV-NC1EP.
*5 DM0 to 32766 for KV-NC1EP.

3-2 Set up Individual Items

This section describes how to set up individual items in the Unit Editor.

Basic

■ Leading DM No.

Sets up the leading DM No. used by EtherNet/IP Units.
Setting range may be restricted by "option setting" of the Unit Editor.

■ Leading relay No. (set up by channel)

Sets up the leading No. of relays used by EtherNet/IP Units by channel.
Setting range may be restricted by "option setting" of the Unit Editor.

■ Communication rate

Communication rate can be selected as "100/10Mbps Auto" or "10Mbps".
In case of "100/10Mbps automatic", once connected to Ethernet, the operating speed on HUB side should be identified firstly, and then set to corresponding speed. In case of "10Mbps", transmission rate is 10Mbps (fixed).
Default setting is "100/10Mbps Auto".
Select 10Mbps (fixed) if communication is unstable under 100Mbps.

Point

In case of cyclic (I/O) messages, "100/10Mbps Auto" should be set.
If 10Mbps is set, depending on the data volume of different cyclic (I/O) messages, stable communication may not be realized.

■ IP address setting method

IP address setting method can be selected among "Fixed IP address", "BOOTP -> fixed IP auto switching" or "BOOTP".
If "Fixed IP address" is selected, the system will operate based on the network settings (IP address, subnet mask and default gateway) in Unit Editor.
If "BOOTP" or "BOOTP -> fixed IP auto switching" is selected, IP address can be set up with KV STUDIO or BOOTP server on the network. If "BOOTP -> fixed IP auto switching" is selected, IP address will be stored in the non-volatile memory; therefore, the system will start with the set IP address when powered on next time. If "BOOTP" is selected, IP address should be set via BOOTP server when powered on each time.
Default setting is "Fixed IP address".
"Communication without Unit Setting/BOOTP", page A-5

Point

In case of "BOOTP -> fixed IP auto switching", if IP address is set, the setting (BOOTP -> fixed IP auto switching) stored in the project will be different from the setting (fixed IP address) stored in the unit. Therefore inconsistence will occur during verification.

■ IP address

If the IP address setting method is set to "Fixed IP address", set up an IP address to be assigned to the EtherNet/IP Unit.

IP address refers to the 32-bit value assigned to the units connected in the network.

During Ethernet communication, data are sent based on this address.

IP address is expressed in four parts, each including 8 bits.

Default value is 192.168.0.10.

The setting range of each part is 0 to 255.

IP address assigned to KV-EP21V should be set up according to the instruction of the network administrator.

It is prohibited to set the following IP addresses. If these addresses are set, normal connection is unavailable.

- 0.0.0.0
- 127.0.0.0 to 127.255.255.255
- 224.0.0.0 to 255.255.255.255
- All bits are 0 or 1 in the host part
- All bits of the part other than host are 0 or 1

Point

In the same LAN, IP address set should not be duplicated to other units.

■ Subnet mask

If the IP address setting method is set to "Fixed IP address", set up a subnet mask for the EtherNet/IP Unit network.

Default value is 255.255.255.0. The setting range of each part is 0 to 255.

Follow instructions from the network administrator to set up the subnet mask assigned to the EtherNet/IP Unit.

If 0.0.0.0 or 255.255.255.255 is set, normal connection is unavailable.

Point

Set the same subnet mask in the same subnet. Otherwise, communication is impossible.

■ Default gateway

It should be set up if IP address setting method is set to "Fixed IP address".

It is used to set up the IP address of default gateway units (such as router and server) in the LAN.

Default gateway refers to the routing node when transferring data from the internal LAN to other LAN.

Default value is "0.0.0.0" (not set).

In this case, LAN with different network address can not be accessed.

The setting range of each part is 0 to 255.

Follow instructions from the network administrator to set up the default gateway assigned to the EtherNet/IP Unit.

If 127.0.0.0 to 127.255.255.255 or 224.0.0.0 to 255.255.255.255 is set, normal connection is unavailable.

■ DNS server

Sets up the IP address of DNS server.
DNS server replies corresponding IP address against the domain name query.
Default setting is 0.0.0.0. The setting range of each part is 0 to 255.
If 127.0.0.0 to 127.255.255.255, or 224.0.0.0 to 255.255.255.255 is set, normal connection is unavailable.

■ Receive time out [s]

When using KV STUDIO, KV COM+, DATA BUILDER, or executing uplink communication, MC protocol communication, communication with VT3 or FTP, temporary communication interruption may occur in certain communication path status. Communication via remote access server or Internet is easily interrupted. The allowable communication interruption time for EtherNet/IP Units can be changed to receive time out according to the Ethernet status. It is unnecessary to change it in general.
Default value is "10" (s).The setting range of each part is 10 to 59.

■ Keep-Alive [s]

With Keep-Alive function, whether normal connection with object unit can be kept will be checked in certain time interval during TCP communication (*1). If communication object exception is detected, connection status will be updated automatically. If Keep-Alive function is used, the time interval should be set. It is unnecessary to change it in general.
Default value is "600" (s). The setting range of each part is 0 to 65535.
Keep-Alive function is disabled in case "0" is set.

*1 In case KV STUDIO, KV COM+, uplink communication (TCP), MC protocol communication (TCP), KV socket communication (TCP), mail send/receive, or FTP server is used.

Port No.

Point

Do not use No. 0 to 1023 when changing port No.. If there is any other port No. in use, the set No. should not be duplicate to it.

■ Port No. (KVS)

When Ladder Support Software KV STUDIO, KV COM+ or DATA BUILDER is used for communication with EtherNet/IP Units, the used port No. can be changed. It is unnecessary to change it in general.
Default value is “8500”. The setting range of each part is 1 to 65535.

■ Port No. (uplink)

When uplink communication is used for communication with EtherNet/IP Units, the port No. to be used can be changed. It is unnecessary to change it in general.
Default value is “8501”. The setting range of each part is 1 to 65535.

■ Port No. (VT)

Sets up the port No. for communication with VT3 Series touch panel display. Set up port No. according to the communication setting of VT3 Series. In general, it is not necessary to change the VT3 Series settings and EtherNet/IP Unit settings.
Default value is “8502”. The setting range of each part is 1 to 65535.

■ Port No. (system extension/system extension 2)

The port No. reserved for the system and used by EtherNet/IP Units can be changed. It is unnecessary to change it in general.

■ Simple PLC link port No. (UDP)

When simple PLC link function is used, port No. for data link should be set.
Default setting is "5001". The setting range of each part is 1 to 65535.

■ MC protocol port No. (TCP)

Port No. can be changed in case of MC protocol (TCP) communication.
It is unnecessary to change it in general.
Default value is “5000”. The setting range of each part is 1 to 65535.

■ MC protocol port No.(UDP)

Port No. can be changed in case of MC protocol (UDP) communication.
It is unnecessary to change it in general.
Default value is “5000”. The setting range of each part is 1 to 65535.

Routing Setting

If communication object units exists in different networks, routing setting is required when the network passes through any router other than default gateway.
Default setting is "No". Select "Yes" to execute routing. If "Yes" is selected, the setting column (totally 6 groups) of target IP address, target subnet mask, and router IP address will be displayed.

■ Target IP address

Sets up IP address of communication terminal (node).
Default value is "0.0.0.0" (not set). The setting range of each part is 0 to 255.

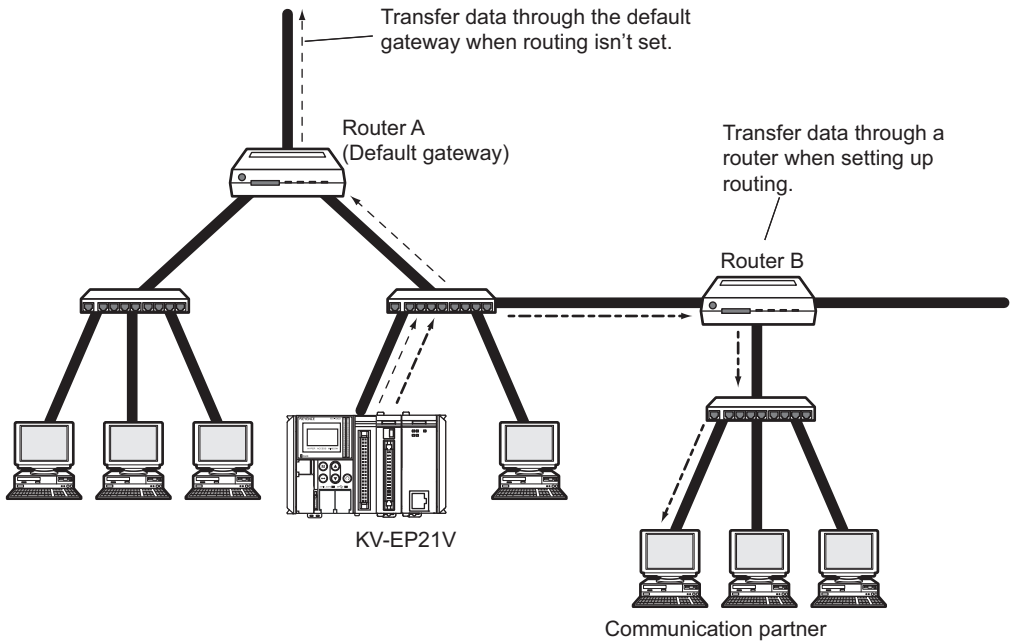
■ Target subnet mask

Sets up the subnet mask of the network where the communication terminal (node) is located.
Default value is "0.0.0.0" (not set). The setting range of each division is 0 to 255.

■ Router IP address

Sets up the IP address of the communication router.
Default value is "0.0.0.0" (not set). The setting range of each part is 0 to 255.

When KV-EP21V sends data to a terminal in the LAN other than its own LAN, normally data are transferred to the default gateway (default router), and then transferred to the target terminal via the default gateway. However, for the LAN configuration shown in the figure below, if the target terminal is not connected via the default gateway, even if data is sent from EtherNet/IP Units, it will not be transferred to the target. In this case, it is necessary to specify the router to the object LAN. For more information, Consult the network administrator.



EtherNet/IP Setting

■ Auto assignment setting

In case "Enable" is set, if the device for cyclic (I/O) messages with EtherNet/IP Devices (adapter, scanner) is assigned automatically, the leading address should be assigned for the device No. of devices used for cyclic (I/O) messages of other units.
If "Disable" is set, the leading No. of bit device and leading No. of word device in case of device auto assignment should be set up separately.
If "Enable" is set, B is assigned for bit device, and W for word device.
In all units, the device leading No. assigned for cyclic (I/O) messages can be set in the "EtherNet/IP Device setting" under "Option setting" of Unit Editor.

■ Assign bit device leading No.

It should be set up if auto assignment setting is disabled.
It is used to set up the leading bit address of device for cyclic (I/O) messages with EtherNet/IP Device (adapter, scanner).
Default value is B000.
The setting range is R1000 to 99900, B000 to 3FF0, DM0 to 65534, and W0000 to 3FFE*.
* For KV-NC1EP: R1000 to 59900, B000 to 1FF0, DM0 to 32766, and W000 to 3FFE.

■ Assign word device leading No.

It should be set up if auto assignment setting is disabled.
It is used to set up the leading word address of device for cyclic (I/O) messages with EtherNet/IP Device (adapter, scanner).
Default setting is W0000. The setting range is DM0 to 65534* and W0000 to 3FFE*.
* DM0 to 32766 when using KV-NC1EP.

■ Upper limit of refresh (word/scan)

Sets up the refresh communication traffic per scan during auto refresh.
The upper limit of refresh is applicable for both input and output.
Default value is "252" (word/scan). The setting range of each part is 0 to 65535.
If 0 or a value larger than the maximum number of refreshed words (KV-EP21V; 24576, KV-5500: 16384, KV-NC1EP: 8192) is set, the setting of upper limit of refresh will be disabled.
For the operation in case the upper limit of refresh is set, see 🕮 "Upper limit of refresh (refresh communication bandwidth limit)", page 4-52.

■ Auto start cyclic (I/O) messages

Sets whether or not to start cyclic (I/O) messages automatically when the EtherNet/IP Unit is started up.
Even if auto start is not set, the communication can also start by specifying target EtherNet/IP Device and setting cyclic (I/O) messages restart request relay to ON.
Default setting is "Enable".

■ Cyclic (I/O) messages error detection mask time (connection) [s]

In case of cyclic (I/O) messages start or restart, if normal communication is unavailable within cyclic (I/O) messages error detection mask time, cyclic (I/O) messages error will occur. Even if the power ON time of scanner is different from that of adapter, cyclic (I/O) messages can be also started without error.
Default value is "60" (s). The setting range of each division is 1 to 120.
For cyclic (I/O) messages error, see "Cyclic (I/O) messages error", page A-8.

■ Cyclic (I/O) messages error detection mask time (disconnection) [s]

If exception (communication time out) occurs during cyclic (I/O) messages, and cyclic (I/O) messages error detection mask time (disconnection) expires, it's regarded as a cyclic (I/O) messages error.
Default setting is "5" (s). The setting range of each part is 1 to 120.
For cyclic (I/O) messages error, see "Cyclic (I/O) messages error", page A-8. If reconnection is executed within cyclic (I/O) messages error detection mask time (disconnection), the error will be recorded in error log.

■ Explicit messages time out [ms]

Sets up time out value of explicit messages (client)/node status acquisition/backup sensor settings/batch transmission sensor settings/sensor setting command/sensor monitor. When the EtherNet/IP Unit executes each function, internal explicit messages will be carried out. For each function, if the time between the EtherNet/IP Unit sending the command and the Ethernet unit responding exceeds the set value, an explicit messages time out error (complete code 10500) will occur.
The setting range is 10ms to 65530ms (increment: 10ms). Default setting is 10000ms (10s).

■ Retry time (system extension) [s]

Sets up retry time for system extension. It is unnecessary to change it in general.
Default value is "60" (s). The setting range of each part is 0 to 180.

■ TTL for multicast

TTL is the abbreviation of Time To Live. It is used to set up how many layers of network the sent data packets exceed and survive, when the EtherNet/IP Unit sends multicast packets to other scanners. It is unnecessary to change it in general.
Default value is "1". The setting range of each part is 1 to 255.
For multicast, see "Multicast", page 4-32.

■ Multicast address specifying mode

Sets up the assignment method for multicast addresses used when the EtherNet/IP Unit sends multicast packets to other scanners. If "Auto assignment" is set, the multicast addresses will be automatically assigned. If "Specified by user" is set, multicast addresses following the leading multicast address will be assigned. It is unnecessary to change it in general.
Default value is "Auto assignment".
For multicast, see "Multicast", page 4-32.

■ Number of multicast addresses

It should be set up if multicast address is specified by user.
It is used to set up the upper limit of number of multicast addresses for sending multicast packet.
Default value is "256". The setting range of each part is 1 to 256.

■ Leading multicast address

It should be set up if multicast address is specified by user.
It is used to set up the upper limit of number of multicast addresses for sending multicast packet. The addresses following the address set here will be used for multicast addresses.
Leading multicast address + address of (number of multicast addresses - 1) should not exceed 239.255.255.255.
Default value is 239.255.0.0. The setting range is 224.0.0.0 to 239.255.255.255.
It's recommended to use multicast addresses within the range of 239.255.00 to 239.255.255.255 in EtherNet/IP.

■ Enable IGMP query send

If "Enable" is set, KV-EP21V will send IGMP query in the IGMP query send interval [s]. When using Ethernet switch with multicast packet filter function (IGMP snooping function), it can be used in case there is no unit (router) sending IGMP query in the network.
For multicast packet filter function of Ethernet switch, see "Multicast packet filter function", page 2-10.

■ IGMP query send interval [s]

Sets up the send interval in case IGMP query send is set to "Enable".
Default value is "60" (s). The setting range of each part is 1 to 18000.

■ EtherNet/IP setting

To set up communication between EtherNet/IP Units and EtherNet/IP Devices, start up EtherNet/IP Setting.
"Chapter 5 HOW TO USE EtherNet/IP SETTING"

FTP Client Setting

■ FTP client setting

When using FTP client function, FTP client setting tool should be started up.
"Chapter 12 FTP CLIENT FUNCTION"

FTP Server Setting

It should be set up when FTP server function is used.

■ Enable FTP server

"Enable" should be set when FTP server function is used.
Default setting is "Disable".

■ Password

Sets up the password for connection using FTP server function.
When the FTP server function is used, the client (PC) must be validated by the server (EtherNet/IP Unit). When executing FTP connection, "User name" and "Password" should be entered. Connection is available only when correct user name and password are entered.
User name is set to "KV" (half-width upper-case characters) (*1) (fixed).

*1 Use the user name of "KVIE" (half-width upper-case characters) when Microsoft Internet Explorer is used to execute FTP. If the user name of "KV" (half-width upper-case characters) is used in this software, normal function is unavailable due to software restrictions.
The password of user names "KV" and "KVIE" is universal.

Default setting is "Not set". In case of "Not set", connection will be established as long as user name for validation is entered.
The password should be the combination of half-width alphanumeric characters and " _ " within 8 characters. Password is case-sensitive.

"Chapter 11 FTP SERVER", 11-1

■ FTP server RUN/PROG switching

To display/hide the file for RUN/PROG switching under the root directory of CPU unit. When accessing FTP server, if RUN/PROG of CPU unit cannot be switched, it is necessary to specify "NO".

Simple PLC Link Setting

■ Simple PLC link setting

It's necessary to start the simple PLC link setting tool if the simple PLC link function is to be used.

"Chapter 13 SIMPLE PLC LINK FUNCTION"

MC Protocol Communication

Set this up when the MC protocol communication function is used for communication with EtherNet/IP Units.

■ MC protocol communication code

MC protocol communication code can be selected as "Binary" or "ASCII".
Default setting is "Binary".

■ MC protocol name code

Sets up MC protocol communication name which is read with CPU name read command during MC protocol communication.
Default setting is "0035(H)" (when KV-5500 is used), "0034(H)" (when KV-5000 is used), "0033(H)" (when KV-3000 is used), "0080(H)" (when KV-NC32T is used), "0084(H)" (when KV-N60** is used), "0085(H)" (when KV-N40** is used), "0086(H)" (when KV-N24** is used), or "0087(H)" (when KV-N14** is used).
The setting range is 0000 to FFFF(H).

■ MC protocol name

Sets up MC protocol communication name code which is read with CPU name read command during MC protocol communication.
Default setting is "V5500" (when KV-5500 is used), "V5000" (when KV-5000 is used), "V3000" (when KV-3000 is used), "KVNC32" (when KV-NC32T is used), "KV-N60" (when KV-N60** is used), "KV-N40" (when KV-N40** is used), "KVN24" (when KV-N24** is used), or "KV-N14" (when KV-N14** is used).
The setting range is ASCII character string within 16 characters.

Mail Setting

■ Mail setting

It's necessary to start the mail setting tool if the mail send/receive function is to be used.
"Chapter 10 MAIL SEND/RECEIVE"

Auto Clock Data Adjustment Function

■ Auto clock adjustment

It should be set up when auto clock data adjustment function is used.

Item	Description
Not use	Auto clock adjustment function is not used. Default setting is "Not use".
Specify time	To adjust clock data automatically at the specified time.
Specify interval	To adjust clock data automatically according to the specified time period.

■ SNTP communication time out [ms]

The allowable communication interruption time between EtherNet/IP Units and NTP (SNTP) servers can be changed.
Default value is "60".The unit is "ms". The setting range of each part is 10 to 65000.

■ Clock adjustment time [h]

Sets up "Hour".
Default value is "0". The setting range of each part is 0 to 23.

■ Clock adjustment time [m]

Sets up "Minute".
Default value is "0". The setting range is 0 to 59.

■ Clock adjustment time [s]

Sets up "Second".
Default value is "0". The setting range is 0 to 59.

■ Clock adjustment interval [m]

Sets up the time period to adjust the clock data.
Default value is "60". The unit is "Minute". The setting range is 0 to 65000.

It is used to set up the difference between Greenwich standard time (GMT) and local time in GMT offset.

■ GMT offset

Sets up "+" (increase) or "-" (decrease).
Default setting is "+".

■ GMT offset [h]

Sets up "Hour".
Default value is "9". The setting range is 0 to 23.

■ GMT offset [m]

Sets up "Minute".
Default value is "0". The setting range is 0 to 59.

■ GMT offset [s]

Sets up "Second".
Default value is "0". The setting range is 0 to 59.

■ NTP(SNTP)server

Sets up the IP address of NTP (SNTP) server that used for getting time.
NTP(SNTP) server is used to provide time information.
Default value is "0.0.0.0" (not set). The setting range of each part is 0 to 255.
When DNS server is used, it can be specified according to the HOST name format.
(Example)smtp.abc.com

Point

Default gateway should be set up if NTP(SNTP) server outside the subnet is used.

4

EtherNet/IP COMMUNICATION

This chapter describes the operating principles and functions of EtherNet/IP communication, as well as necessary communication settings.

4-1 Overview of EtherNet/IP Communication Functions 4-2
4-2 Overview of EtherNet/IP Communication Functions and Setting Tools 4-5
4-3 Cyclic (I/O) Messages Function. 4-6
4-4 Explicit Messages (Client) Function. 4-96
4-5 Explicit Messages (Server) Function 4-119
4-6 Node Status Acquisition Function 4-155
4-7 Appendix 4-172

4-1 Overview of EtherNet/IP Communication Functions

This section gives a general description on EtherNet/IP communication function.

Overview of EtherNet/IP Communication Function

EtherNet/IP is an industrial multi-vendor network system, which not only supports device-level communication (field network), but also controller-level communication. The following describes the various functions based on EtherNet/IP.

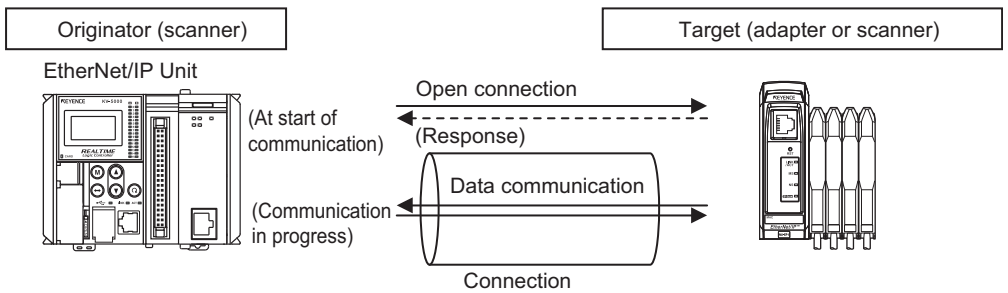
■ Cyclic (I/O) messages

This function carries out cyclic (fixed period) communication of data between EtherNet/IP Units and EtherNet/IP Devices.

During cyclic (I/O) messages, the unit at one end opens a logic communication line (i.e., connection) to the target unit. If opening is successful, data communication is executed.

The terminal that opens the connection is called originator, while the terminal to which connection is opened is called target. Generally, the unit working as originator (which opens connection) is called scanner, and the unit only working as target (to which connection is opened) is called adapter. (Scanner can not only serves as originator, but also as target.)

"4-3 Cyclic (I/O) Messages Function", page 4-6



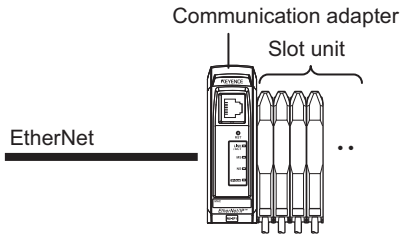
Reference

Rack configuration of EtherNet/IP Device

Some adapters and scanners have rack configuration.

EtherNet/IP Device with rack configuration is called rack configuration unit, which consists of communication adapter connected to Ethernet and slot unit connected on the communication adapter.

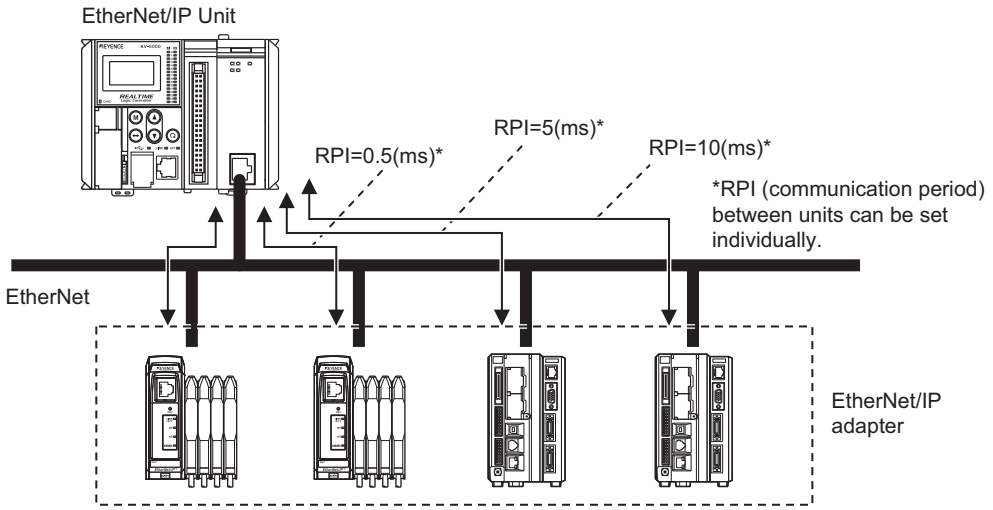
Example) EtherNet/IP communication unit NU-EP1 from KEYENCE is a rack configuration unit, which can be used after NU-EP1 (communication adapter) and sensor (slot unit) are connected.



For rack configuration unit, connection setting should be executed for communication adapter or for each slot unit.

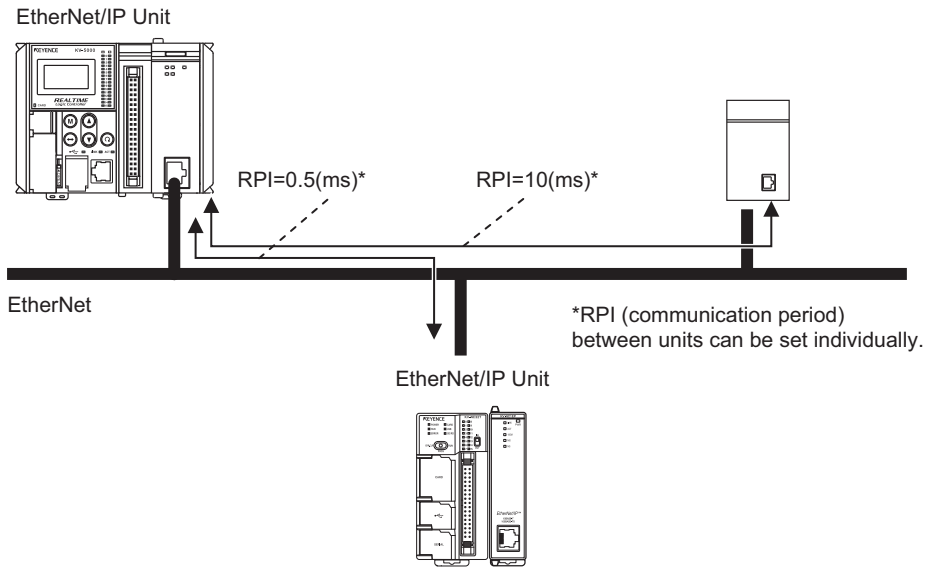
● Cyclic (I/O) messages between EtherNet/IP Units and EtherNet/IP adapters (device-level communication)

For EtherNet/IP Units, a communication period can be set separately for each adapter, and cyclic (I/O) messages can be sent.



● Cyclic (I/O) messages between EtherNet/IP Units and EtherNet/IP scanners (controller-level communication)

For EtherNet/IP Units, a separate communication period can be set for the scanner, and cyclic (I/O) messages can be sent.

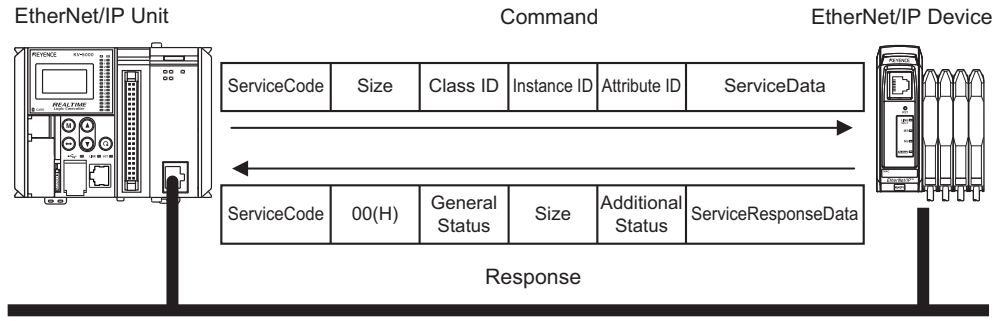


■ Explicit messages (client) function

This function allows sending messages to EtherNet/IP Device with explicit messages specified in EtherNet/IP communication specification.

Program for explicit messages is required.

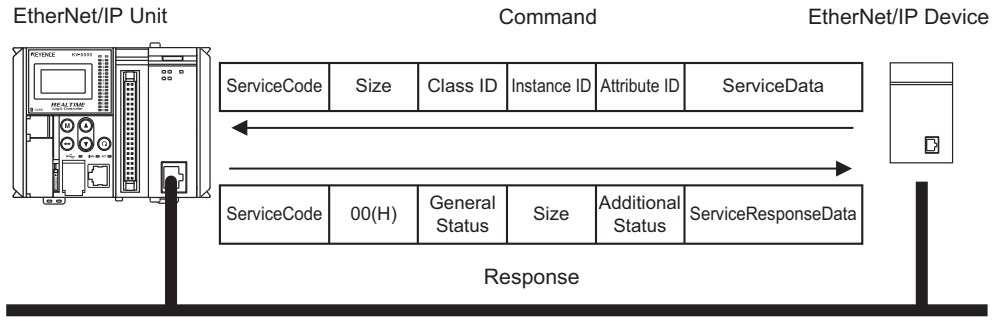
"4-4 Explicit Messages (Client) Function", page 4-96



■ Explicit messages (server) function

This function allows the EtherNet/IP Unit to carry out processes according to commands sent from EtherNet/IP Devices, and send responses.

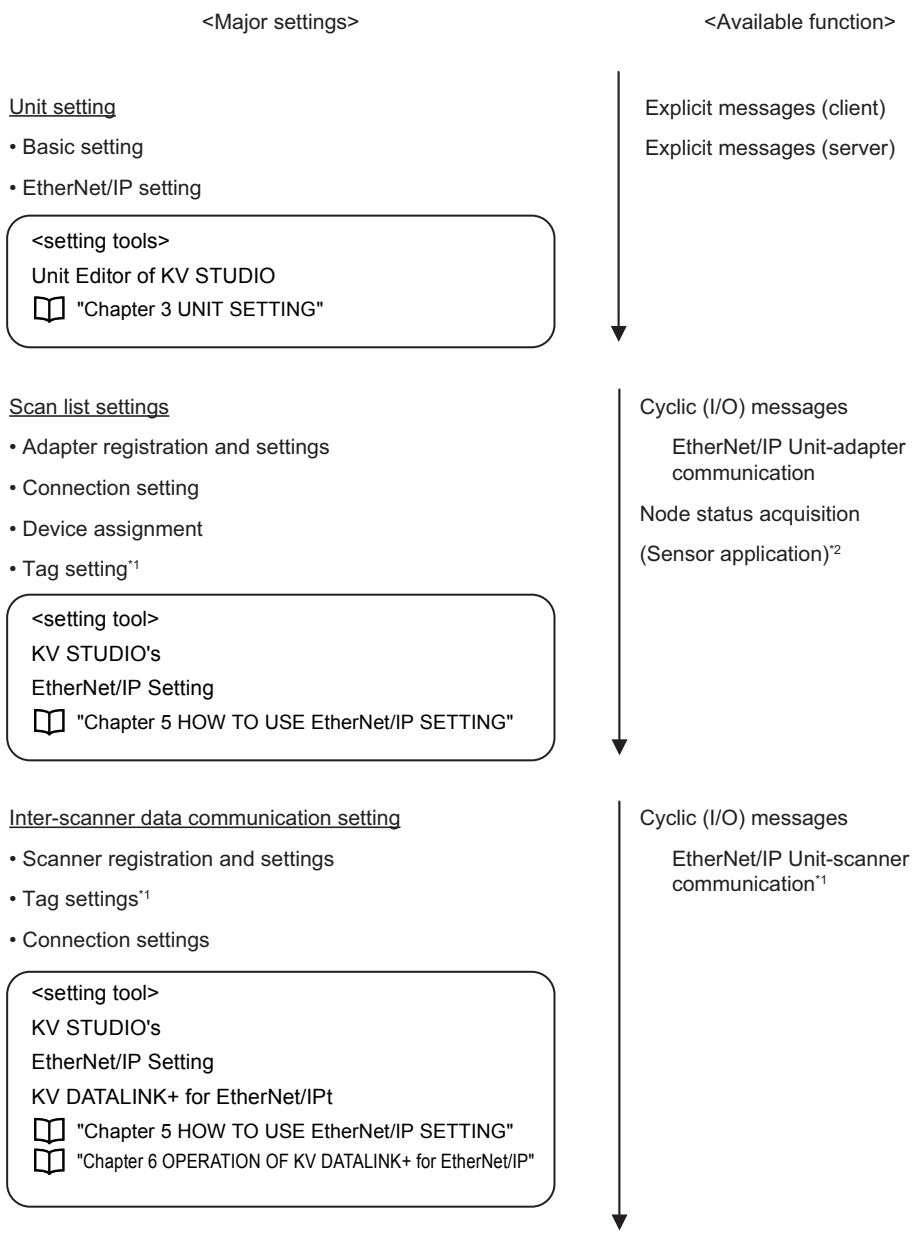
"4-5 Explicit Messages (Server) Function", page 4-119



4-2 Overview of EtherNet/IP Communication Functions and Setting Tools

This section describes settings and relevant setting tools required for EtherNet/IP communication function.

Relationship of EtherNet/IP Communication Functions and Setting Tools



*1 With KV DATALINK+ for EtherNet/IP, a data link (tag setting, connection setting) between scanners can be set easily following the wizard.

*2 For the setting necessary for using the sensor application function, see "Chapter 7 SENSOR APPLICATION".

4-3 Cyclic (I/O) Messages Function

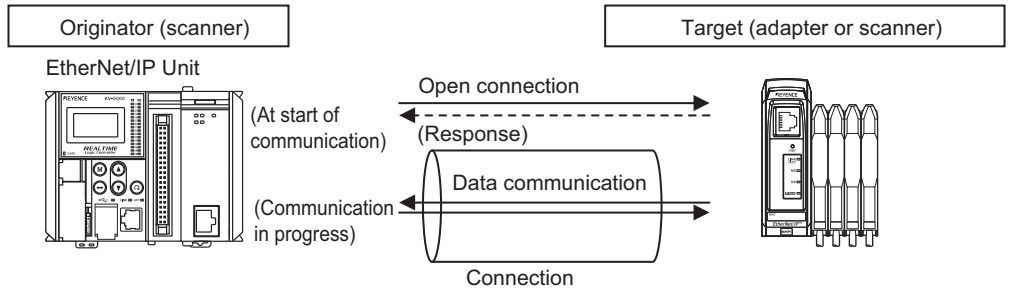
The following describes the cyclic (I/O) messages function and how to use it.

Overview

This section gives a general description of the cyclic (I/O) messages function.

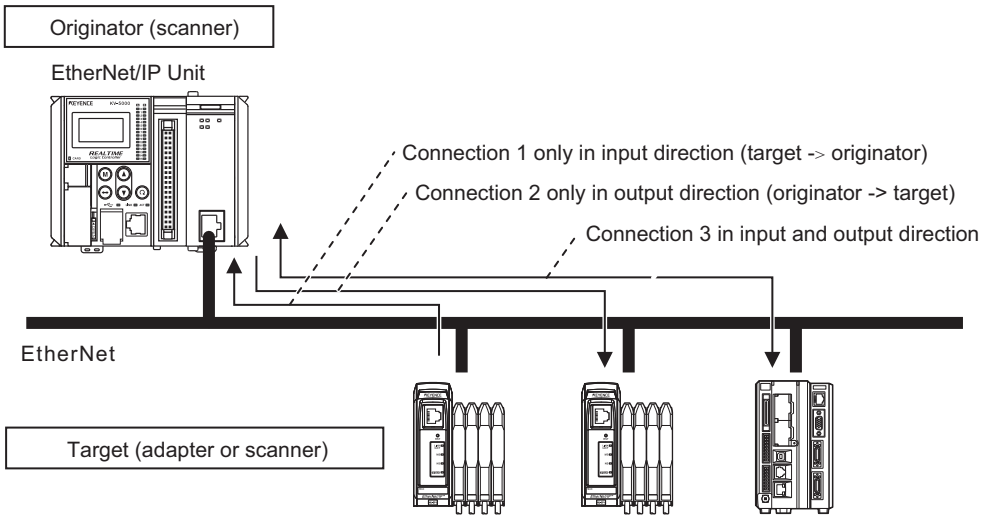
■ What are cyclic (I/O) messages

EtherNet/IP Units communicate data with EtherNet/IP Devices periodically (fixed period).
During cyclic (I/O) messages, the unit at one end opens a logic communication line (i.e., connection) to the target. If opening is successful, data communication is executed.
The terminal that opens the connection is called originator, while the terminal to which connection is opened is called target unit. Generally, the unit working as originator (which opens connection) is called scanner, and the unit only working as target (to which connection is opened) is called adapter. (scanner can not only serves as originator, but also as target.)



■ What is connection

Connection refers to the logic communication line opened between EtherNet/IP Units and EtherNet/IP Devices. During cyclic (I/O) messages, when communication starts, originator (scanner) opens the connections to the target units (scanner or adapter). Connection settings include a data send/receive setting with the target unit and RPI (communication period) etc.



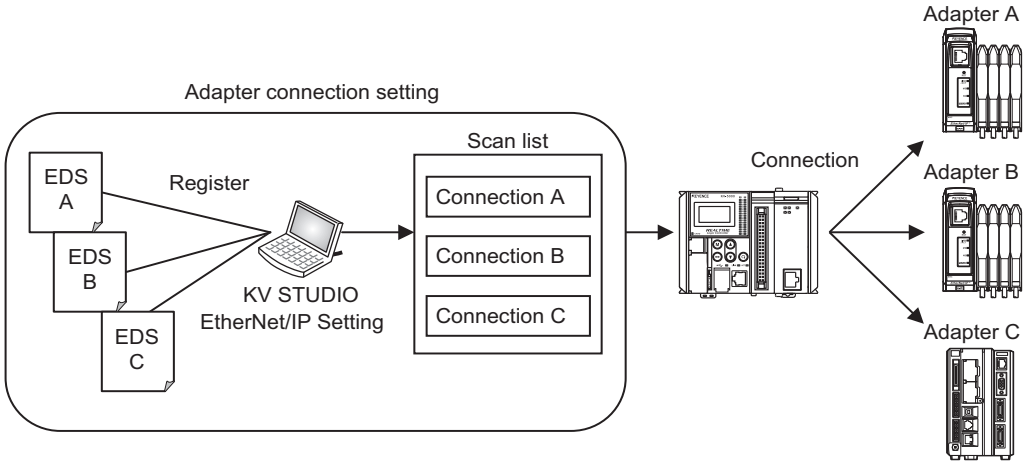
Point

RPI (communication period) can be set up separately for each connection.

● Connection settings between EtherNet/IP Units and EtherNet/IP adapters

The connection settings are executed for each adapter, such as the data send/receive setting and communication period.

The settable connection for the adapter is defined in the EDS file* prepared for the units. With EtherNet/IP Setting of KV STUDIO, connection settings can be executed easily according to the definition in the EDS file of each registered unit.



* EDS file

EDS (Electric Data Sheets) file is in text format, which defines unit specific information such as vendor name, EtherNet/IP Device data send/receive settings, and parameter specifications. For how to receive an EDS file, please consult the manufacturer of each EtherNet/IP Device.

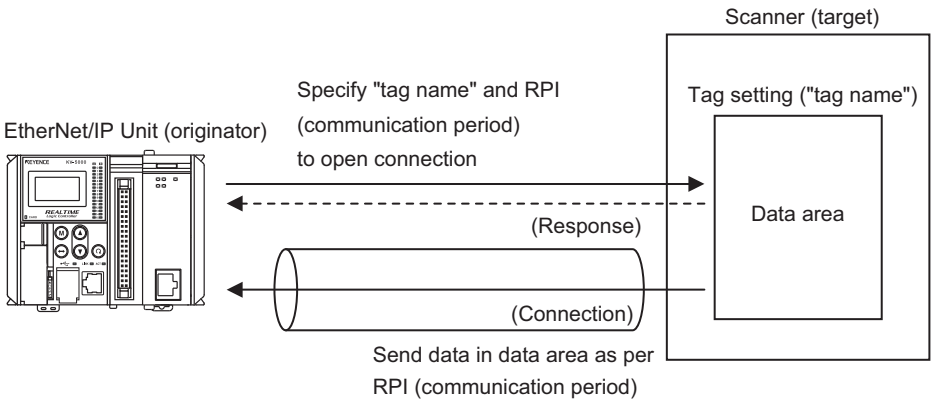
● Connection settings between EtherNet/IP Units and EtherNet/IP scanners

For any data sent/received between scanners, data send setting should (i.e., tag setting) be defined for each scanner.

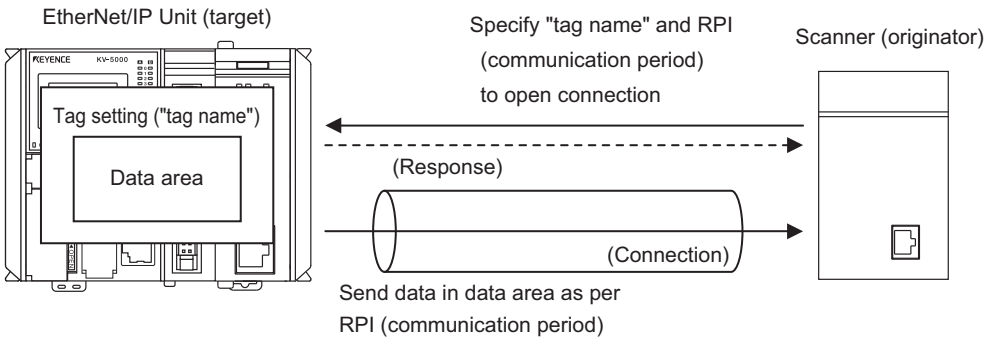
The EtherNet/IP Unit (originator) specifies the tag name and the RPI (communication period) for the data area defined as the tag setting in the target scanner (target), and opens the connection for receiving data. When sending data from the EtherNet/IP Unit to the scanner, a connection should be opened from the scanner for the tag setting in the EtherNet/IP Unit.

"Tag Setting", page 4-38

When EtherNet/IP Units receive data from other scanners



When EtherNet/IP Units send data to other scanners



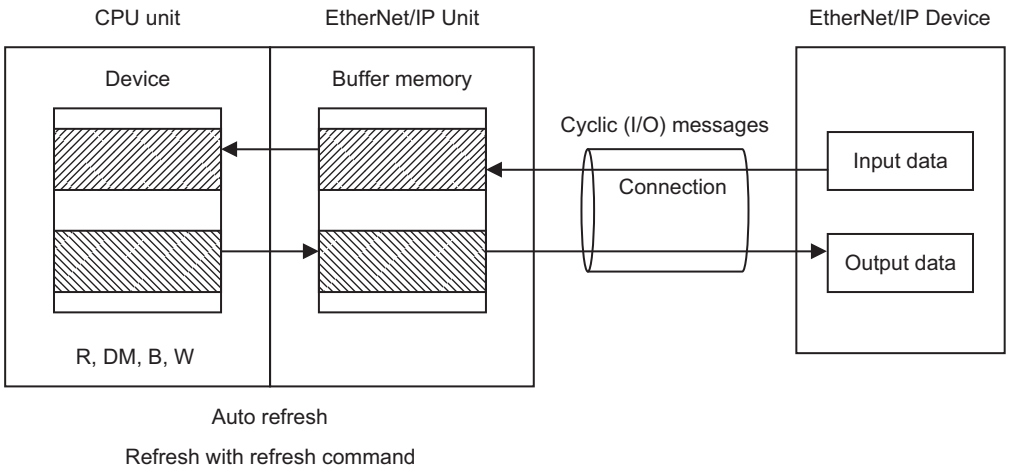
■ Communication data assignment to CPU device and refresh

EtherNet/IP communication send/receive data stored in the EtherNet/IP Unit buffer memory, and the assigned CPU unit device will be refreshed automatically.

When a specific command for refresh is used, buffer memory value of CPU unit device can be refreshed at any time.

Assignable device types include R, B, DM and W, EtherNet/IP Setting in KV STUDIO is used to assign devices.

"Refresh CPU Device and Communication Data", page 4-50



From Cyclic (I/O) Messages Setting Steps to Operation

The following describes the steps from setting to operation when using cyclic (I/O) messages function.
To create a scan list, the EDS file of each EtherNet/IP Device is required.
For how to get the EDS file, please consult the vendor of each EtherNet/IP Device.

■ When inspecting the EtherNet/IP Device on the network and creating a scan list

Set up the EtherNet/IP Unit with the KV STUDIO Unit Editor.

"Unit Editor Setting for Cyclic (I/O) Messages Function", page 4-11

↓

Transfer project (unit setting) from KV STUDIO to CPU unit.

KV STUDIO User's Manual

↓

Create scan list with EtherNet/IP Setting.

- Register EDS file of EtherNet/IP Device to be used (only for initial use).

  Point **It is unnecessary to register EDS file for EtherNet/IP Device from KEYENCE.**

- Use the "Search unit" tab to search for EtherNet/IP Devices connected to the EtherNet/IP Unit.

""Search Unit" Tab", page 5-24

- Set up IP address of EtherNet/IP Device.

  Point **"Search unit" tab can be used to set up IP address.**

- The searched EtherNet/IP Device can be registered to scan list by dragging and dropping.

  Point **Connection is set up automatically when dragging and dropping.**

For change of connection setting, and operation details of EtherNet/IP Settings, see

"Chapter 5 HOW TO USE EtherNet/IP SETTING", page 5-1.

↓

Transfer project (unit setting) from KV STUDIO to CPU unit.

KV STUDIO User's Manual

↓

Settings end

↓

Auto start cyclic (I/O) messages

"Start and Stop of Cyclic (I/O) Messages", page 4-21

When the power is turned ON or settings are changed, the EtherNet/IP Unit starts cyclic (I/O) messages automatically.

■ When settings are transferred to EtherNet/IP Units after a scan list is created

Set up the KV-EP21V unit with Unit Editor of KV STUDIO.

"Unit Editor Setting for Cyclic (I/O) Messages Function", page 4-11

Create scan list with EtherNet/IP Setting.

"Scan List Settings", page 4-12

- Register EDS file of EtherNet/IP Device to be used (only for initial use).

Point **It is unnecessary to register EDS file for EtherNet/IP Device from KEYENCE.**

- Register EtherNet/IP Device connected with KV-EP21V (adapter, scanner) by dragging and dropping.

Point **Connection is set up automatically when dragging and dropping.**

For change of connection settings, and operation details of EtherNet/IP Setting, see

"Chapter 5 HOW TO USE EtherNet/IP SETTING", page 5-1.

Transfer project (unit setting) from KV STUDIO to CPU unit.

KV STUDIO User's Manual

Set up IP address of EtherNet/IP Device.

"Search unit" tab of EtherNet/IP Setting can be used to set up IP address of EtherNet/IP Device.

""Search Unit" Tab", page 5-24

Setting end

Auto start cyclic (I/O) messages

"Start and Stop of Cyclic (I/O) Messages", page 4-21

When the power is turned ON or settings are changed, the EtherNet/IP Unit starts cyclic (I/O) messages automatically.

Unit Editor Setting for Cyclic (I/O) Messages Function

The following describes settings of the Unit Editor of KV STUDIO for cyclic (I/O) messages function. Please set an appropriate value for other setting items in "Basics" of the Unit Editor as required.

"Setting Item List", page 3-4

Unit Editor Setting

Item	Setting range	Default value	See page
"Basic"			
Leading DM No.	0 to 65304 (0 to 32538 for KV-NC1EP)	Setting is required	3-6
Leading relay No. (ch unit setting)	10 to 960 (10 to 560 for KV-NC1EP)	Setting is required	3-6
Baud rate	"100/10Mbps automatic"/"10Mbps"	100/10Mbps automatic	3-6
Setting method of IP address	Fixed IP address/BOOTP->Fixed IP auto switching/BOOTP	Fixed IP address	3-6
IP address	(0 to 255).(0 to 255).(0 to 255).(0 to 255)	192.168.0.10	3-7
Subnet mask	(0 to 255).(0 to 255).(0 to 255).(0 to 255)	255.255.255.0	3-7
EtherNet/IP Setting			
Automatic distribution setup	Enable / Disable	Enable	3-11
Start No. of the distribution bit device	R1000 to 99900, B000 to 3FF0[*1] DM0 to 65534[*2], W0000 to 3FFE	B000	3-11
Start No. of the distribution word device	DM0 to 65534[*2], W0000 to 3FFE	W0000	3-11
Update upper limit (word/scan)	0 to 65535	252	3-11
cyclic(I/O) messages starts automatically	Enable/Disable	Enable	3-11
Cyclic (I/O) messages error detection mask time (when connected) [s]	1 to 120	60	3-12
Cyclic (I/O) messages error detection mask time (when disconnected) [s]	1 to 120	5	3-12
Explicit messages time out (ms)	10 to 65530	10000	3-12
Retry time (system extension) [s]	0 to 180	60	3-12
Multicast TTL	1 to 255	1	3-12
Multicast address designation method	Automatic assignment/specify by user	Auto assignment	3-12
Number of multicast addresses	1 to 256	256	3-13
Multicast initial address	(224 to 239).(0 to 255).(0 to 255).(0 to 255)	239.255.0.0	3-13
IGMP query sending	Disable/Enable	Disable	3-13
IGMP query sending interval [s]	1 to 18000	60	3-13
EtherNet/IP Settings	"Setting"		3-13

*1 B000 to 1FF0 for KV-NC1EP.

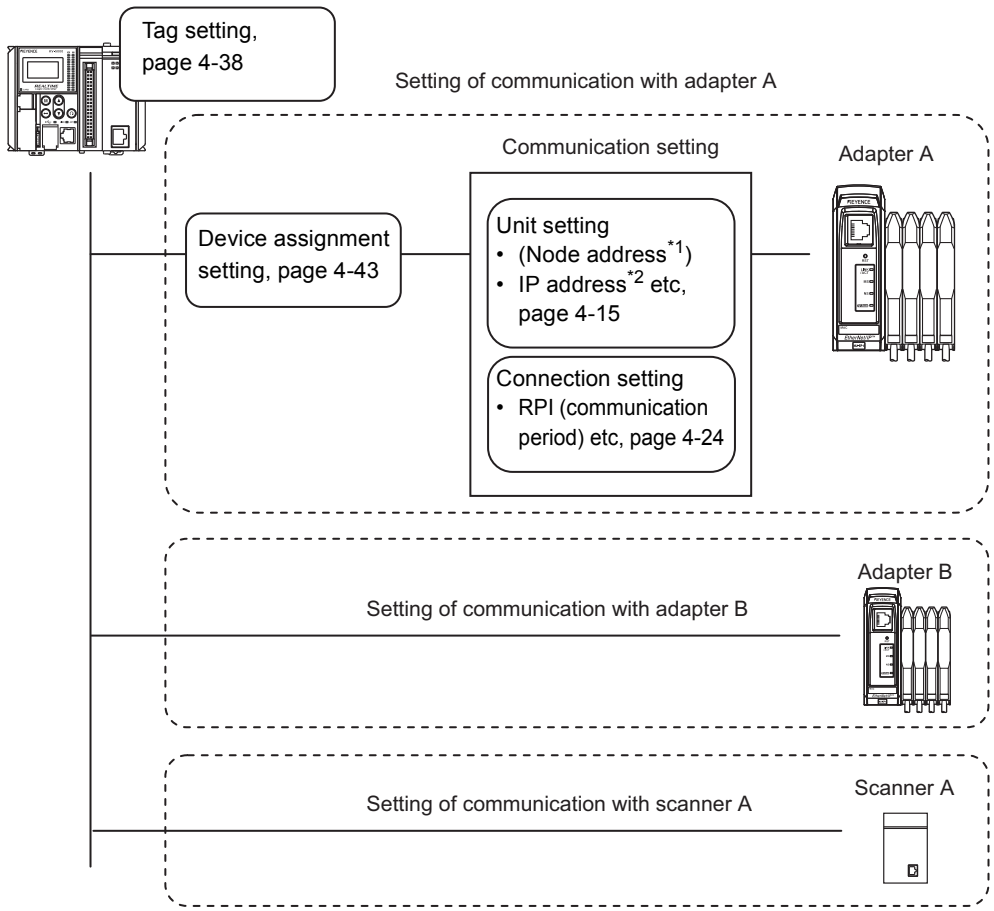
*2 DM0 to 32766 for KV-NC1EP.

Scan List Settings

EtherNet/IP Units execute cyclic (I/O) messages with registered devices according to the scan list set in KV STUDIO EtherNet/IP Settings.

■ Scan list setting

In the scan list, the communication settings for each target unit (adapter or scanner) should be set.
In EtherNet/IP Setting, the connection setting and initial setting of device assignment can be completed automatically, when dragging and dropping the EtherNet/IP Device by using the registered EDS file.



*1 The node address is used to specify the EtherNet/IP Device from within the EtherNet/IP Unit, but not for actual EtherNet/IP communication. Therefore, it is unnecessary to set up a node address in each EtherNet/IP Device. The node address can also be used in node status acquisition and sensor application functions.

*2 Please set up the IP address of the target unit (adapter or scanner) in each EtherNet/IP Device.

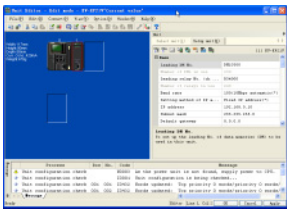
■ Register EtherNet/IP Device to scan list

The scan list can be created with the EtherNet/IP Setting of KV STUDIO.
Registration can be achieved by dragging & dropping from the EtherNet/IP Device list registered with the EDS file registered. The following describes basic procedures for registering the EtherNet/IP Device to the scan list.
For details, see "Register Unit to Scan List", page 5-12.

1 Use Unit Editor of KV STUDIO to connect the KV-EP21V.

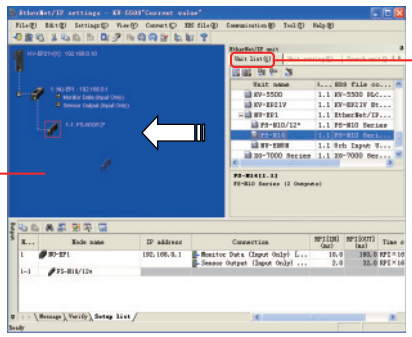
"3-1 Unit Editor Setting", page 3-2

2 Click the icon in the "Setup unit (2)" tab of Unit Editor to start the EtherNet/IP Setting.



Other procedure
- Double click adapter (slot unit) in the workspace of KV STUDIO to start.
- In the KV STUDIO workspace, right click EtherNet/IP Unit and select EtherNet/IP Setting from the displayed menu to start.
- In the Unit Editor, right click the unit to be set, and select EtherNet/IP Setting from the displayed menu to start.
- Select "Tool(T)"->"EtherNet/IP Setting(W)" from the menu of KV STDUIO.

3 Select the EtherNet/IP Device to be registered from "Unit List" tab in the EtherNet/IP Device area, and drag and drop it to the scan list area.



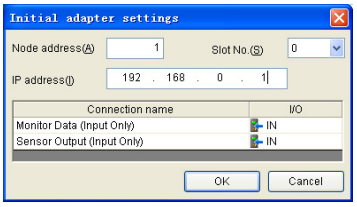
Other procedure
- Select EtherNet/IP Device in "Unit List" tab, and select "EDS file(D)"=>"Add to scan list(A)" from the menu.
- Select EtherNet/IP Device in "Unit List" tab, and select "Add to scan list" from the right-click menu.
- Select EtherNet/IP Device in "Unit List" tab, and double click it or press Enter key.

For "Unit List" tab, see ""Unit List" Tab", page 5-16.

Reference
The "Unit List" tab in the EtherNet/IP Device area can be used to register the EtherNet/IP Device connected to the EtherNet/IP Unit to the scan list.
""Search Unit" Tab", page 5-24

Point
If an EtherNet/IP Device from other companies is used, the EDS file of the EtherNet/IP Device should be registered first.
"Register to "Unit List" tab of EtherNet/IP Device (EDS file)", page 5-18

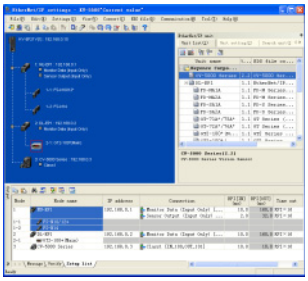
4 **Set up node address and IP address via the "Initial Adapter Settings" dialog box displayed during configuration.**



Point

The IP address and connection setting displayed in "Initial Adapter Settings" dialog box will be set to the default value.

5 **Repeat 2 and 3 for other EtherNet/IP Devices to complete registration in the scan list.**



Adapter connection is set to default during configuration.
If there is no problem with the default setting, setting of the scan list is completed.
After KV STUDIO is used to send the project (unit setting) to CPU unit, and IP address settings of each EtherNet/IP Device is completed, cyclic (I/O) messages can be started.

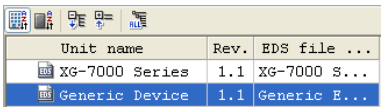
To send cyclic (I/O) messages soon, see "Start and Stop of Cyclic (I/O) Messages", page 4-21.

In case of changing various settings, see
"Target EtherNet/IP Device Setting", page 4-15
"EtherNet/IP Unit (Originator) Unit Settings", page 4-19
"Connection Settings", page 4-24
"Assignment method of CPU device", page 4-43.

In case of executing data link with other scanners, see
"Chapter 6 OPERATION OF KV DATALINK+ for EtherNet/IP"
"Tag Setting", page 4-38.

Reference

For an EtherNet/IP Device whose EDS file is unaccessible, please use the Generic Device registered in "Unit List" tab. Communication can be enabled if matched with the EtherNet/IP Device that will be used, and, using the parameter setting of the dialog box of the connection settings and setting the generic device via the connection point or data size options. For communication with Generic Device, compatibility check is not executed.



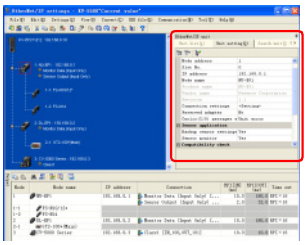
Target EtherNet/IP Device Setting

Set up the target EtherNet/IP Device (adapter or scanner) in "Unit Setting" tab of the EtherNet/IP Setting.

When communication starts, the EtherNet/IP Unit opens a connection for the target unit (scanner or adapter) in the scan list.

■ Display and setting item list of "Unit Settings" tab

1 Select EtherNet/IP Device in EtherNet/IP Setting, and double click it to display the "Unit Setting" tab.



Item	Setting range	Default value	See page
<Adapter Setting>			
Node address	1 to 256	*1	4-16
Slot No.	0 to 255	*1	4-16
IP address	(0 to 255),(0 to 255),(0 to 255),(0 to 255)	*1	4-16
Node name	<= 32 half-width characters	Unit name	4-16
Slot name	<= 32 half-width characters	Unit name	4-16
Product name	-	(Unit Name)	4-16
Vendor name	-	(Vendor name)	4-16
Revision	-	(Revision)	4-16
Connection settings	"Setting"	-	4-16
Reserved adapter	Enable/Disable	Disable	4-17
Cyclic (I/O) messages error	As unit error Not as unit error	As unit error	4-17
<Sensor application>			
Backup sensor settings	Enable/Disable	*2	4-17
Sensor monitor	Enable/Disable	*2	4-17
<Compatibility check>			
Cyclic (I/O) messages	Check model consistency In accordance with adapter rules Not check	In accordance with adapter rules	4-18
Sensor application	Check model consistency Check model compatibility Check series compatibility Not check	*2	4-18
Series code	-	(Series code)	4-18
Series version	-	(Series version)	4-18
Product code	-	(Product code)	4-18
Revision	-	(Revision)	4-18

*1 Blank value is set to default value automatically during configuration.

*2 Default value will be different depending on the EtherNet/IP Device selected.

"Unit Settings" tab Settings

■ Adapter settings

● Node address

Set up node address of the selected EtherNet/IP Device.
The setting range is 1 to 256.
For rack configuration unit, if the communication adapter is selected, it is displayed; if the slot unit is selected, it will not be displayed.
The node address is used to specify the EtherNet/IP Device from within the EtherNet/IP Unit, but not for actual EtherNet/IP communication. Therefore, it is unnecessary to set up a node address in each EtherNet/IP Device. A node address can also be used in node status acquisition and sensor application functions.

● Slot No.

Set up the slot No. of the selected EtherNet/IP Device.
It is displayed when the slot unit of the rack configuration unit is selected.
The slot No. that can be selected differs according to the EtherNet/IP Device.

● IP address

Set up the IP address of the selected EtherNet/IP Device.
The following IP addresses cannot be set. If these addresses are set, normal connection is unavailable.

- The same IP address as the EtherNet/IP Unit
- 0.0.0.0
- 127.0.0.0 to 127.255.255.255
- 224.0.0.0 to 255.255.255.255
- All bits are 0 or 1 in the host part
- All bits are 0 or 1 in the non-host part

● Node name

Set up the node name of the selected EtherNet/IP Device.
The set node name is displayed in the scan list.
The setting range is up to 32 half-width characters.

● Slot name

Set up the slot name of the selected EtherNet/IP Device.
The set slot name is displayed in the scan list.
The setting range is up to 32 half-width characters.

● Product name/vendor name/revision

The product name (unit name)/vendor name/revision defined in the EDS file of the selected EtherNet/IP Device, up to 64 characters can be displayed respectively.
The revision number represents the version of the EtherNet/IP Device when any function is added.

● Connection setting

Click the "Setting" button to change the connection setting of the selected EtherNet/IP Device.

● Reserved adapter

The selected EtherNet/IP Device can be reserved.
Default value is "Disable". The setting range is "Enable" and "Disable".
For rack configuration unit, it is displayed if the communication adapter is selected; if the slot unit is selected, it will not be displayed.

● Cyclic (I/O) messages error

In case an error occurs on the cyclic (I/O) messages with the selected EtherNet/IP Device, when cyclic (I/O) messages error node table of the buffer memory is ON, set whether it is a unit error or not.
Default value is "as unit error".
For rack configuration unit, it is displayed if the communication adapter is selected; if the slot unit is selected, it will not be displayed.
"A-4 Error List", page A-8

■ Sensor application

Setting of the communication between the EtherNet/IP Unit and the selected EtherNet/IP Device is described.

● Backup sensor settings

If the EtherNet/IP Device that can use the backup sensor settings function is selected, set whether the backup sensor settings are on or off.
The default value of the EtherNet/IP Device from KEYENCE is "Enable". The default value of the EtherNet/IP Device from other companies is "Disable".
"Backup Sensor Settings", page 7-7

● Sensor monitor

When selecting a KEYENCE EtherNet/IP Device that can use a sensor monitor function, set whether as display object of the sensor monitor or not.
Default value varies with unit.
"Sensor Monitor", page 7-41

■ Compatibility check

To start or restart EtherNet/IP communication, check whether the EtherNet/IP Device registered in the scan list is consistent with the presently connected EtherNet/IP Device according to the setting of compatibility check.

Communication with the EtherNet/IP Device is unavailable in case of an unmatched model.

Two methods of compatibility checks are available. One is to check whether the host content of the EtherNet/IP Device connected to the EtherNet/IP Unit is consistent with the content defined in the EDS file, and the other is to check the compatibility of the EDS file content according to the check rules of the adapter.

● Cyclic (I/O) messages

To start or restart cyclic (I/O) messages, set whether compatibility check is executed.

Item	Description
Start No. of the distribution bit device	Check whether the settings are completely consistent with vendor ID, device type, product code, major revision of the used machine.
According to adapter rules	Check according to the check rules of each adapter.
No check	Do not execute compatibility check.

● Sensor application

Set whether to execute compatibility check when sensor application function is used.

Item	Description
Check model consistency	Check whether the settings are completely consistent with vendor ID, device type, product code, major revision of the used machine.
Check model compatibility	It will be displayed if the KEYENCE adapter is selected. Check whether the setting is consistent with vendor ID, device type, product name of real machine, and major revision (setting) <= major revision (real machine).
Series compatibility check	Series code and series version displays on EtherNet/IP Devices. Check whether the setting is consistent with vendor ID, device type, and series code of real machine, and series version (setting) <= series version (used machine).
No check	Do not execute compatibility check.

● Series code/series version

Series code/series version is displayed if the EtherNet/IP Device from KEYENCE is selected, and the series code is provided.

When the "Compatibility check" is set to "Check series compatibility", check vendor ID and device type, and series version (setting) <= series version (used machine), but do not check product code.

● Product code

Product code defined in the EDS file of the selected EtherNet/IP Device will be displayed.

● Revision

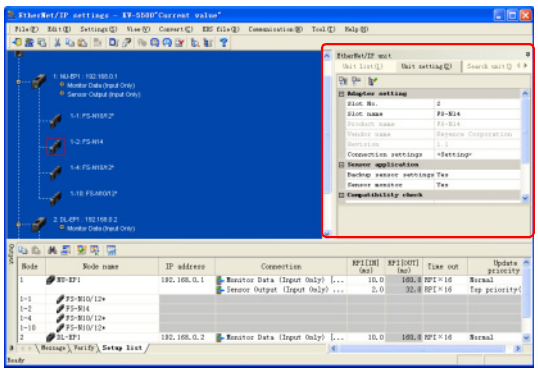
Revision of the EtherNet/IP Device is displayed in the format of "MajRev.MinRev". The revision number represents the version of EtherNet/IP Device when any function is added.

EtherNet/IP Unit (Originator) Unit Settings

Unit setting of the EtherNet/IP Unit is executed in the "Unit Setting" tab.

■ Display and settings of the "Unit Setting" tab

1 Select EtherNet/IP Unit in EtherNet/IP Setting, and double click to display the "Unit Setting" tab.



Item	Setting range	Default value	See page
<Scanner setting>			
IP address	*	192.168.0.10	4-19
Unit comments	-	(Unit comments of the Unit Editor)	4-19
Product name	-	(Unit name)	4-20
Vendor name	-	(Keyence Corporation)	4-20
Revision	-	(Revision)	4-20
Tag setting	"Setting"	-	4-20
<Sensor application>			
Setup backup sensor settings	"Setting"	-	4-20
Setup batch transmission sensor settings	"Setting"	-	4-20

* (0 to 255),(0 to 255),(0 to 255),(0 to 255)

■ Scanner setting

● IP address

Set the EtherNet/IP Unit IP address.

The IP address changed here will be updated to IP address of the Unit Editor.

The following IP addresses cannot be set. If these addresses are set, normal connection is unavailable.

- The same IP address as the connected EtherNet/IP Device
- 0.0.0.0
- 127.0.0.0 to 127.255.255.255
- 224.0.0.0 to 255.255.255.255
- All bits are 0 or 1 in the host part
- All bits are 0 or 1 in the non-host part

● Unit comments

Display unit comments set to the EtherNet/IP Unit in the Unit Editor.

● Product name

Display unit name.

● Vendor name

Display vendor name (Keyence Corporation).

● Revision

Unit revision is displayed in the format of "MajRev.MinRev".

The revision number represents the version of the EtherNet/IP Device when any function is added.

● Tag setting

Click "Setting" button to add/change tag setting.

■ Sensor application

● Setup backup sensor settings

Click "Setting" button to set up backup sensor settings.

"Setup backup sensor settings", page 7-12

● Setup batch transmission sensor settings

Click "Setting" button to set up batch transmission sensor settings

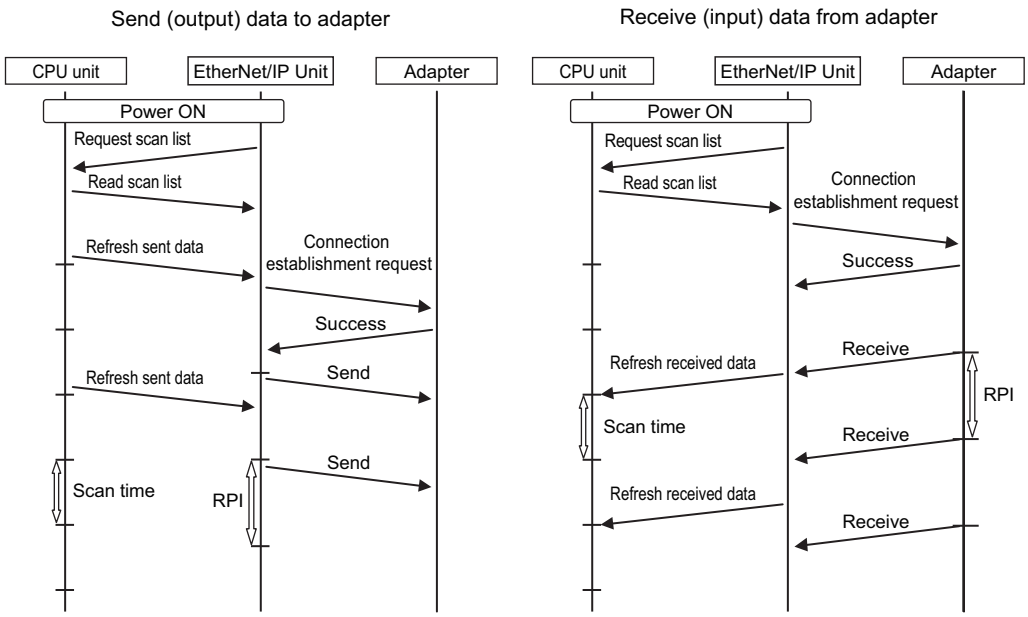
"Setup batch transmission sensor settings", page 7-51

Start and Stop of Cyclic (I/O) Messages

When powered on, cyclic (I/O) messages start automatically.
If "Auto start cyclic (I/O) messages" is set to "Disable" in Unit Editor of KV STUDIO, it is started after the cyclic (I/O) messages restart request relay is ON.

■ Start of cyclic (I/O) messages (operation when turned ON)

When turned on, the EtherNet/IP Unit opens the connection to the target unit (scanner or adapter) registered in the scan list automatically. If a connection is opened successfully, data will be sent/ received for each set RPI (communication period).



* When the EtherNet/IP Unit is KV-5500, data is refreshed between the CPU unit and interior region. When it is KV-NC1EP, data is refreshed between KV-NC1EP and the base unit.

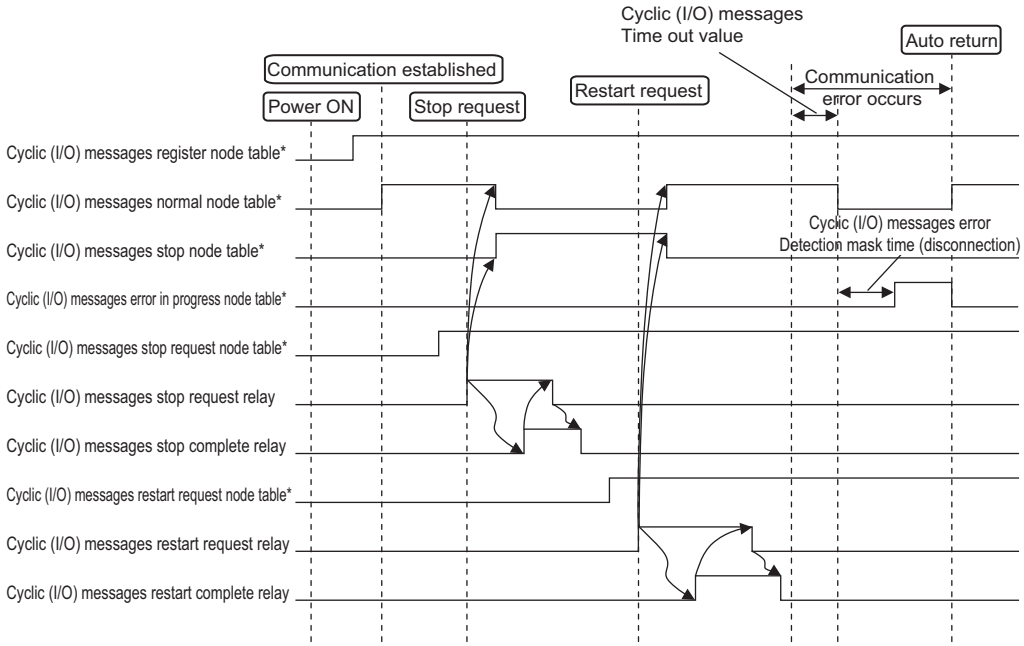
■ Operation in PROG mode

CPU unit can also execute cyclic (I/O) messages in PROG mode.

■ Operation time chart of cyclic (I/O) messages

Time chart of cyclic (I/O) messages.

For device content and device No., see "Devices used in cyclic (I/O) messages", page 4-63.



* ON/OFF of the bit corresponding to the node is displayed.

Reference

- In case of the power is turned ON or restart of cyclic (I/O) messages, if a communication error occurs, the bit corresponding to the error node table will be ON after the cyclic (I/O) messages error detection mask time (connection).
- If "as unit error" is selected in the cyclic (I/O) messages error setting of the adapter setting in the EtherNet/IP Setting, unit error is displayed upon the cyclic (I/O) messages error node table ON, and error details are stored in the error code.

■ Operation in case of scan list update and Reset service

- If the scan list is changed, or the Reset service is executed for the EtherNet/IP Unit, cyclic (I/O) messages (and auto refresh) of all adapters are stopped, and a new scan list setting is used to open the connection again to start cyclic (I/O) messages.
- If the EtherNet/IP Unit is the originator (which opens the connection), when cyclic (I/O) messages stop, a communication time out occurs on the adapter, so that a disconnection request is not executed. After a communication time out occurs on the adapter, and the connection is cut off, a new scan list can be used to open the connection. If the RPI setting is large, a longer time out value is detected for the adapter, so it will take some time to open the connection again.
- If the EtherNet/IP Unit is the target unit (to which the connection is opened), when cyclic (I/O) messages stop, data is not sent, and a communication time out occurs on the originator.

Point

CPU unit can execute a scan list change and Reset service in PROG mode.

■ Cyclic (I/O) messages stop

If a communication error occurs, and a stop request is executed via the Ladder program, cyclic (I/O) messages will stop. Operation upon stoppage due to different causes is as follows.

Item		Stop caused by communication error	Stop caused by stop request
Buffer memory	Cyclic (I/O) messages normal node table	Corresponding bit OFF	Corresponding bit OFF
	Cyclic (I/O) messages stop node table	Corresponding bit OFF	Corresponding bit ON
	Cyclic (I/O) messages error node table	Corresponding bit ON	Corresponding bit OFF
DM	Error code	If cyclic (I/O) messages error is "as unit error", error cause is stored. *1 "Cyclic (I/O) messages error", page 4-17	-
	Detailed error code		-
	Error node address		-
	Error slot No.		-
	Error connection No.		-
	Error vendor ID		-
Input data		Hold	Hold
Output data		Hold	Hold
Restart operation		After error cause is eliminated, cyclic (I/O) messages restart automatically*2	Restart cyclic (I/O) messages when executing restart request

*1 For the error code when a communication error occurs, see "Cyclic (I/O) Messages Error List", page A-10.

*2 When a communication error occurs, the EtherNet/IP Unit makes unlimited attempts to send a restart the connection request every 10 seconds. If a connection can be opened normally, cyclic (I/O) messages restart automatically.

For steps to stop and restart cyclic (I/O) messages using the Ladder program, see "Cyclic (I/O) Messages Stop Request and Restart Request", page 4-67.

Connection Settings

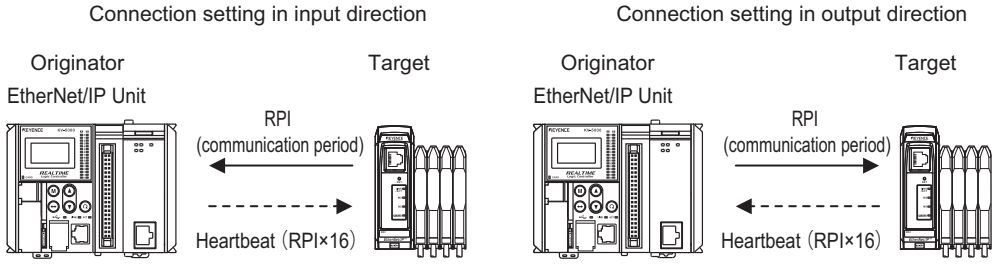
Set up the EtherNet/IP Unit connection to send/receive data to/from the adapter or scanner.

Reference In the EtherNet/IP Settings of KV STUDIO, the connection setting can be executed easily according to the definition in the EDS file of each registered unit.

■ Basics of connection setting

The connection setting is used to set up data to send/receive between the originator (EtherNet/IP Unit) and target unit (adapter or scanner), and to set up communication data size, data I/O direction, RPI (communication period) etc.

Connection can be set to I/O only, or both input and output. (if unidirectional connection is used, data sent* called Heartbeat, which is used to check communication status, is also executed periodically in the unset direction.)



* Data send (Heartbeat) for communication status check is executed at 16 times of the set RPI (communication period).

■ Performance specification related to connection setting

Item		KV-5500	KV-EP21V	KV-NC1EP
Number of connections		256 *1		64 *1
RPI (communication period)		0.5 to 10000ms (unit: 0.5ms) It can be set for each connection. (irrelevant to number of nodes, update data on the line according to the set period)		
Send trigger	Output to adapter	Cyclic		
	Input from adapter	Cyclic / Change of state *2		
Max. number of refresh words		16k words	24k words	8k words
Max. data size per connection *3		504 bytes or 1444 bytes		
Multicast packet filter function *4		Available (IGMP client function)		

*1 Maximum number of connections used in Class3 (connection type) explicit messages function is 256 (64).

*2 Communication with unit that outputs data in Change of state (send data in case of change) mode is available. EtherNet/IP Units (KV-EP21V, KV-5500 and KV-NC1EP) themselves cannot output data in Change of state mode.

*3 Data synchronism in the connection is ensured. If above 505 bytes are used, the unit used should support Large Forward Open (CIP option specification).

*4 EtherNet/IP Units (KV-EP21V, KV-5500 and KV-NC1EP) are provided with the IGMP client, therefore, if the Ethernet switch supporting IGMP Snooping is used, unnecessary multicast packets can be filtered out.

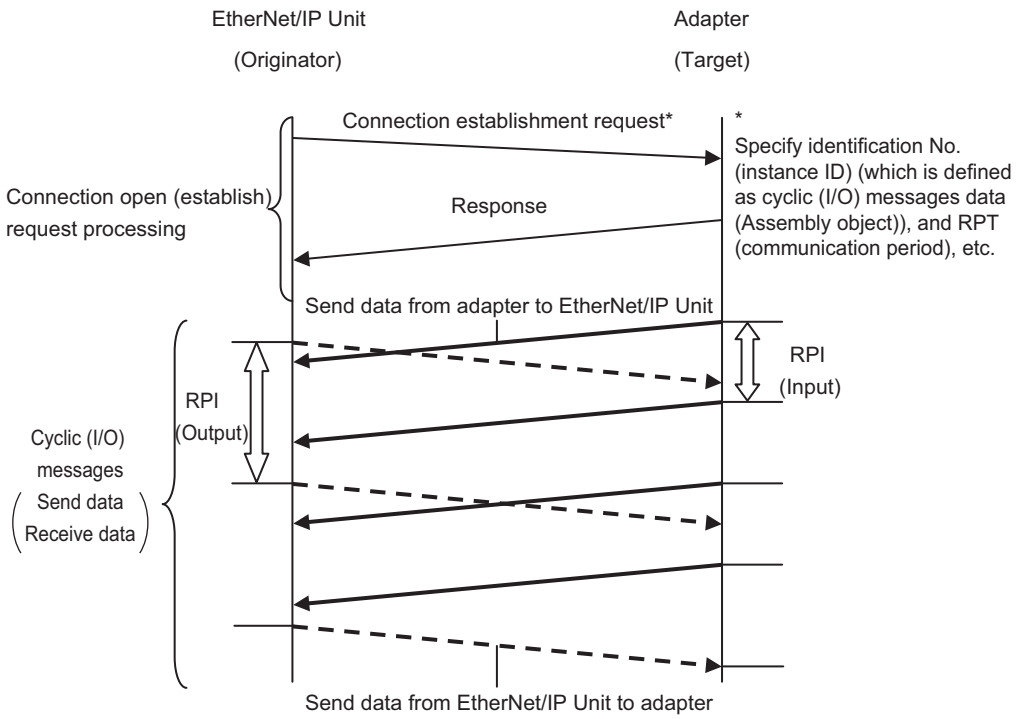
■ Connection settings with adapter

For cyclic (I/O) messages with the adapter, the identification No. (instance ID) that is defined as cyclic (I/O) messages data (Assembly object) in the EDS file of the adapter should be specified, and connection for data I/O should be set.

In EtherNet/IP Setting of the KV STUDIO, the EDS file of each unit can be used for connection setting, it is unnecessary to identify the instance ID etc.

For communication between the EtherNet/IP Unit and the adapter, the EtherNet/IP Unit (originator) opens (establishes) a connection for the adapter (target unit). After the connection is established, data is sent/received according to the selected RPI (communication period).

The sent/received data in cyclic (I/O) messages is data sent by the originator and the target unit at their own timing (RPI), so synchronism between the sent data and received data cannot be guaranteed.



Reference Multiple connections can be set simultaneously depending on adapter. (e.g., EtherNet/IP communication unit NU-EP1 from KEYENCE)

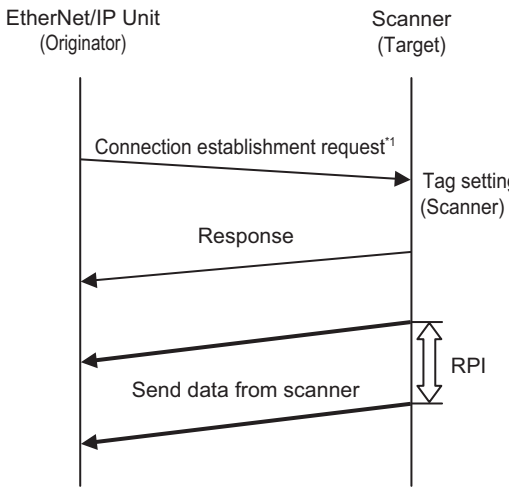
■ Connection settings with scanner

When the EtherNet/IP Unit receives data from other scanners, the connection should be opened for the data area (i.e., tag setting) set in the scanner to receive data.

When the EtherNet/IP Unit sends data to other scanners, a connection should be opened from other scanners for the tag setting in EtherNet/IP Unit.

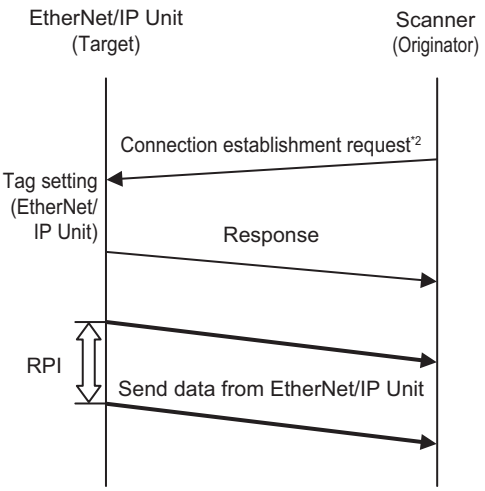
"Tag Setting", page 4-38

<Data received from scanner to the EtherNet/IP Unit>



*1
Specify the tag setting and RPI (communication period) of the scanner from the EtherNet/IP Unit to open the connection

<Data sent from the EtherNet/IP Unit to scanner>



*2
Specify the tag setting and RPI (communication period) of the EtherNet/IP Unit from the scanner to open the connection

Point

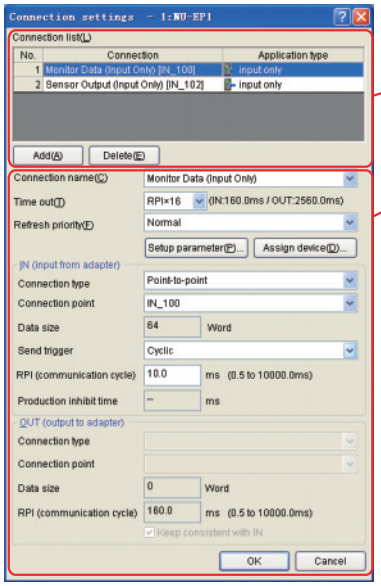
For data of tag setting, only data sent from the direction of the target unit to the originator can be set. For bidirectional data communication, a connection establishment request should be submitted to each other.

■ Display of "Connection setting" dialog box

Display and setting of connection settings are described.

In the scan list of the EtherNet/IP Setting, click the connection name of the target unit (adapter or scanner) to display the "Connection setting" dialog box.

Other procedure
- Select unit, and click "Connection setting" button in the "Unit Setting" tab.
- Select unit, and select "Connection setting" from the right-click menu.
- Select "Setting(S)" ▶ "Connection setting(C)" from the menu.
- Click “Connection setting” button in "Setting List" tab of the output window.



Connection list

Display the set connection name and application type.

Connection information

Display the details of connection selected in the connection list. Set value can be changed as required.

- "Connection information", page 4-29
- "Setting items of IN (input from adapter)", page 4-31
- "OUT (Output to adapter) setting items", page 4-37

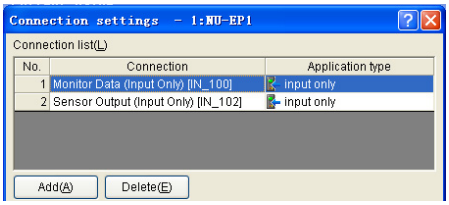
Point

With KV DATALINK+ for EtherNet/IP, data link (tag setting, connection setting) between scanners can be set easily following the wizard.

"Chapter 6 OPERATION OF KV DATALINK+ for EtherNet/IP"

Connection list

■ Display details of the connection list



● Connection

The set connection setting is displayed in the format of
connection name (connection point IN (input from adapter),
connection point OUT (output to adapter)) .

Reference For a target unit (adapter or scanner) without a registered EDS file, UNKNOWN will be displayed.

● Application type

Displays the application type of the selected connection setting.
EtherNet/IP Units support Exclusive Owner, Input Only, and Listen Only application type connections.

Exclusive Owner

This connection enables the setting of both data sent from the EtherNet/IP Unit to the target unit (adapter or scanner), and receiving data from the target unit to the EtherNet/IP Unit.

Input Only

This connection can only be set to receive data from the target unit (adapter or scanner) to the EtherNet/IP Unit.

Listen Only

This connection can only be set to receive multicast type data for the EtherNet/IP Unit, for target units (adapter or scanner) which already have multicast type connections open with Exclusive Owner and Input Only application types.

In the case the multicast type connection is not opened, the Listen Only type connection can not be opened.

If Exclusive Owner or Input Only is used for communication with other originators (scanners) to which the multicast type connection is opened, after all communications are cut off, even if the scanner that is opened by Listen Only communicates normally, sending of multicast type data from the target unit (adapter or scanner) will stop.

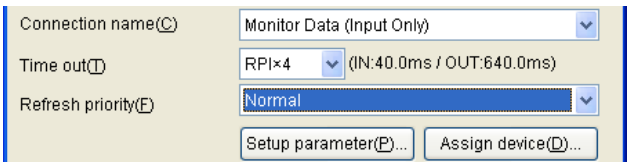
For multicast, see page 4-32.

● “Add” button/“Delete” button

Add/delete connection.
For the adapter, add settable connection defined in the EDS file.
For the scanner, add the connection for specifying tag.
If connection cannot be added, "Valid connection is unavailable" will be displayed.

Connection information

■ Setting items of connection details



● Connection name

Selectable connections defined in the EDS file of the selected EtherNet/IP Device will be displayed, and then can be selected.
Connection name in Japanese will be displayed if a EtherNet/IP Device from KEYENCE is selected.
For the connection of each EtherNet/IP Device, see appropriate manuals.

Point

The following connection cannot be used. For terminologies, see CIP specification.

- **In case send trigger does not support "Cyclic" and "Change of State"**
- **In case connection type does not support "Point to Point" and "Multicast"**
- **In case variable is specified in network connection parameters**
- **In case transmission type is specified as Redundant Owner**
- **In case zero length format is specified for real time format**

● Time out

To set up time out value for cyclic (I/O) messages.
Set to integral multiple of RPI, the setting range is RPI x 4/RPI x 8/RPI x 16/RPI x 32/RPI x 64/RPI x 128/RPI x 256/RPI x 512.
Default value is RPI x 4.
The IN direction (EtherNet/IP Unit) time out value and OUT direction (target unit) time out value will be displayed separately. The time out value must be above 10ms.

● Refresh priority

Set the refresh priority for EtherNet/IP Unit send/receive data, and devices assigned in connection setting.

For device refresh, see "Refresh CPU Device and Communication Data", page 4-50.

Item	Description
Normal	Refresh according to the RPI (communication period) of cyclic (I/O) messages.
Priority	Refresh with priority over "Normal" according to the RPI (communication period) of cyclic (I/O) messages.
Top priority (each scanning)	Refresh upon each scanning of CPU unit.

For details of the selection items, see "Priority setting of refresh communication", page 4-54.

● “Setup Parameter” button

Click “Parameter Setting” button to display “Parameter Setting” dialog box. Connection setting related parameter information is displayed in the dialog box, which can be changed. The settings will be stored in EtherNet/IP Setting data.



- **Parameters/set value/attribute**

  Display parameters No., name, set value, and attribute defined in the EDS file of the selected EtherNet/IP Device. The set value of writable parameters can be changed.

- **"Restore to Default" button**

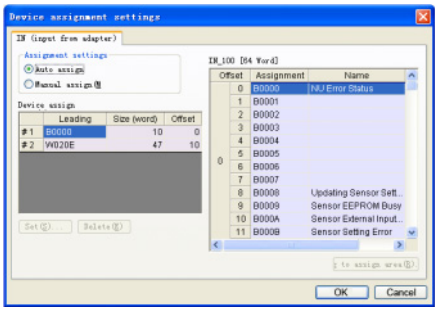
  The set value of parameters is restored to default value defined in the EDS file.

Point

When RPI is displayed in "Parameter Setting" dialog box, the changed RPI value will not be updated to RPI in connection setting. Please change RPI in connection setting directly.

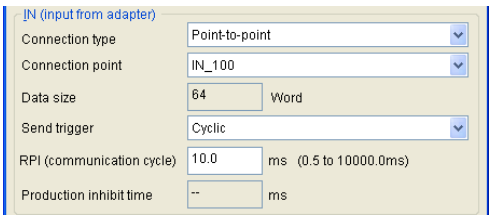
● "Assign device" button

Click "Assign device" button to display "Device assignment setting" dialog box.
Cyclic (I/O) messages data is assigned to the CPU unit device.
For device assignment method, see "Assignment method of CPU device", page 4-43.



Setting items of IN (input from adapter)

It should be set up if the EtherNet/IP Unit receives data from the target unit (adapter or scanner) connection setting is selected.



● Connection type

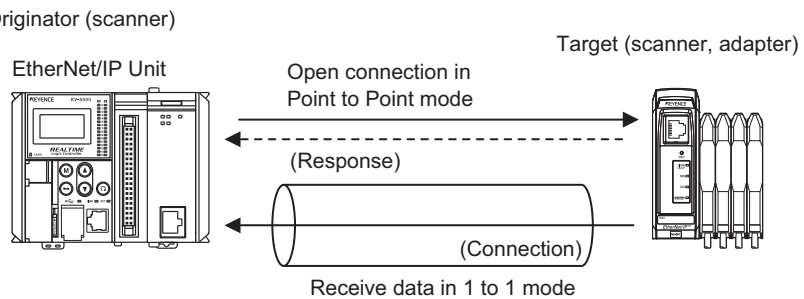
Set the mode (connection type) to send data from the target unit (adapter or scanner).
Settable connection types defined in EDS file is displayed.
EtherNet/IP Units can receive data through Point to Point and multicast connection types.

Item	Description
Point to Point*	Receives data based on Point to Point setting.
Multicast	Receives data based on multicast setting.

* Either connection type can be selected, and default value is "Point to Point".

- **Point to Point**

  Such connection types can be set if the originator (scanner) receives data from the target unit (adapter or scanner) in 1-to-1 mode.

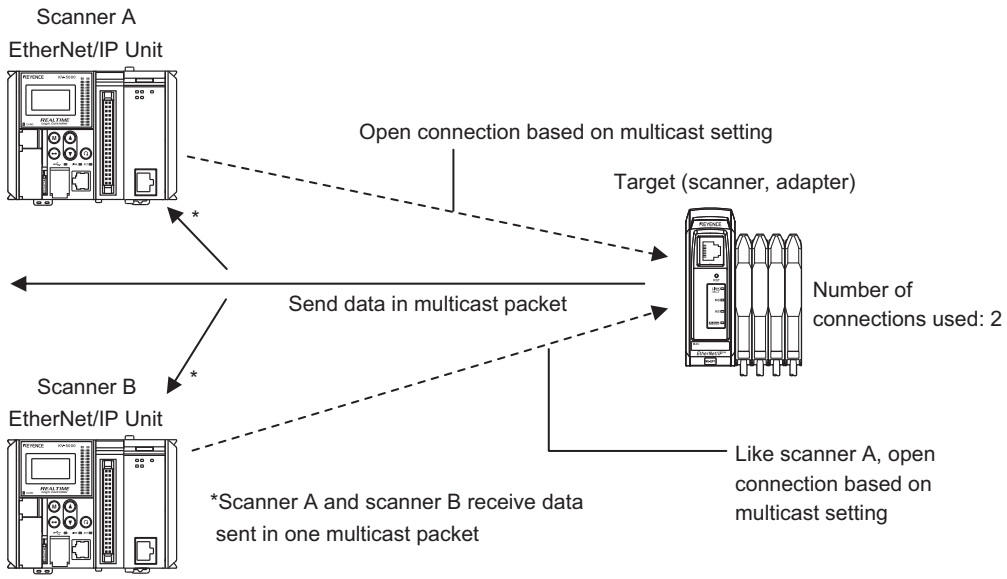


- **Multicast**

  Such connection types can be set if multiple originators (scanners) receive data from one target unit (adapter or scanner).

  If the target unit (adapter or scanner) opens a multicast connection, data is sent in the form of a multicast packet. If other scanners open the same multicast as a connection setting *for the same target unit, a multicast packet from the target unit can be received. When a multicast is used, multiple scanners can receive a multicast packet so as to alleviate communication load in the network.

  * Connection settings with consistent RPI (communication period), connection type (multicast), connection point (or, tag name), data size, and send trigger.



Point

- **If the target unit is opened in multicast mode, only one multicast packet is sent, but the number of connections used is the same as number of scanners opened.**
- **When opening the connection, if inconsistent with the set multicast connection, a cyclic (I/O) messages error will occur (error code 262).**
- **If a multicast connection type is used, please use the Ethernet switch with multicast filter function. If the Ethernet switch without multicast filter function is used, the multi-filter packet will be broadcast to the entire network, and network communication traffic will be increased.**

"Ethernet Switch Used", page 2-9

● Connection point

<Adapter>

Instance ID defined in the EDS file will be displayed in the format of “IN_ instance ID”. Instance ID is the identification No. of cyclic (I/O) messages data defined in the adapter EDS file (Assembly object). After adapter unit opens the connection, the selected instance ID communication data will be sent with the set RPI (communication period).

For data set in each adapter instance ID, see appropriate unit manuals.

<Scanner>

Specify the tag setting defined in the communication object scanner to which the EtherNet/IP Unit will open the connection. Specify the connection point with tag name or instance ID.

Example) in case the communication object scanner is the KV-EP21V

- If the connection name is selected as Input Only (specify tag), set the tag name defined in the EtherNet/IP Unit.
- If the connection name is selected as Input Only (specify instance ID), set the instance ID defined in the EtherNet/IP Unit.

For the tag setting, see "Tag Setting", page 4-38.

Reference With KV DATALINK+ for EtherNet/IP, the data link (tag setting, connection setting) between scanners can be set easily following the wizard.

● Data size

The received data size during cyclic (I/O) messages will be displayed in word.

If the data size is an odd number of bytes, it is displayed after rounding up in word, cyclic (I/O) messages is executed in the form of odd number bytes.

<Adapter>

Display data size defined in the EDS file of the selected connection.

If the data size is a variable adapter, data size can be changed according to the "Parameter Setting" dialog box displayed after clicking the "Parameter Setting" button.

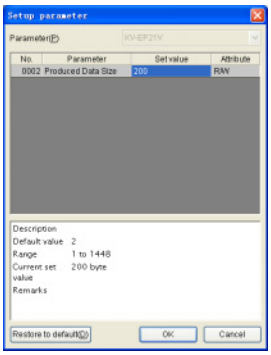
For the parameter name and setting when changing data size, see appropriate adapter manuals.

<Scanner>

Click "Parameter Setting" button to display the "Parameter Setting" dialog box, data size is set in byte according to the tag setting of target unit.

If an EtherNet/IP Unit is used, the data size can be set in byte increments in the "Produced Data Size" parameter. For data size change of other scanners, see appropriate unit manuals.

"Parameter Setting" dialog box



Reference With KV DATALINK+ for EtherNet/IP, data link (tag setting, connection setting) between scanners can be set easily following the wizard.

● Send trigger

Display settable send triggers defined in the EDS file.

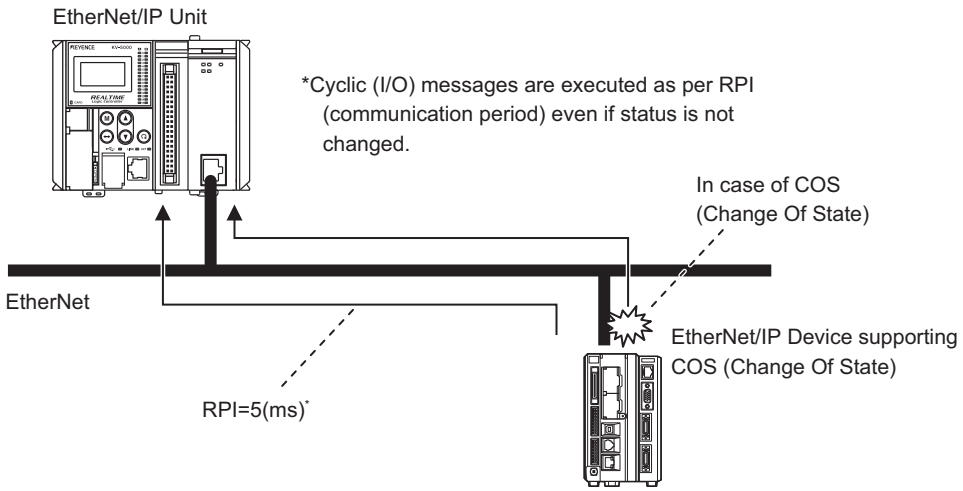
To set up the mode to send data from target unit.

EtherNet/IP Units can receive data based on cyclic and COS (Change Of State) send triggers.

Item	Description
Cyclic	Target unit (adapter or scanner) sends data as per set RPI (communication period).
COS(Change Of State)	When status is changed, the target unit (adapter or scanner) sends data. When the communication object EtherNet/IP Device serves as send trigger, and the COS (Change of State) is supported, it can be selected.

- **COS(Change Of State)**

  When the status is changed, the target unit (adapter or scanner) sends data. So that cyclic (I/O) messages will be executed in parallel as per RPI (communication period) in parallel. Therefore, even if the status has not changed, communication time out will not occur.



Point

- **When a connection has been opened from EtherNet/IP Units with COS (Change Of State) settings, even if the status of the target unit (adapter or scanner) changes continuously, data send will not be executed within the set time of RPI (communication period) x 1/4. To send data during continuous status change in RPI (communication period) x 1/4, see appropriate EtherNet/IP Device manuals.**
  If COS (Change of State) is set, RPI x 1/4 time is called the minimum send interval.
- **EtherNet/IP Units do not support COS (Change Of State) data send.**

● RPI (communication period)

Set communication data period (RPI) of IN direction for cyclic (I/O) messages with the selected EtherNet/IP Device.

The setting range is 0.5 to 10000ms (unit: 0.5ms).

Point

Certain EtherNet/IP Device may not support 0.5ms high-speed RPI (communication period) or may not support settings of 0.5ms units. In this case, please set the RPI supported by the unit according to EtherNet/IP Device manual.

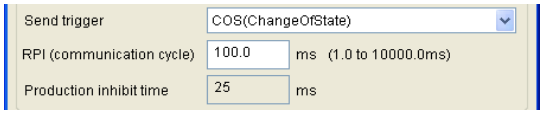
● The minimum send interval

The time of RPI (communication period) **x**1/4 time will be displayed.

The minimum send interval will be that of when COS (Change of State) is set for the send trigger.

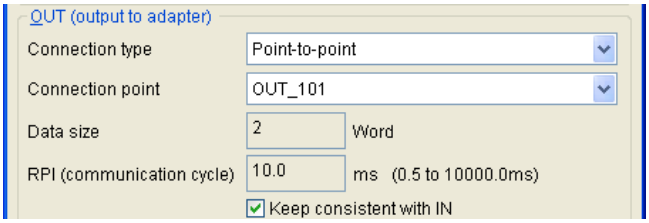
When a connection has been opened from EtherNet/IP Units with COS (Change Of State) settings, even if status of the target unit (adapter or scanner) changes continuously, data send will not be executed during the minimum send interval.

"COS(Change Of State)", page 4-35



OUT (Output to adapter) setting items

It should be set up if the EtherNet/IP Unit send data to the adapter connection setting is selected.
The EtherNet/IP Unit connection cannot be set to send data to the scanner.



● Connection type

Data send mode (connection type) will be displayed.
Only Point to Point data send can be selected for EtherNet/IP Units.
"Point to Point", page 4-31

● Connection point

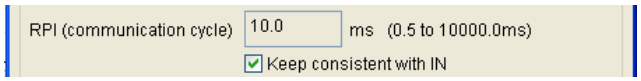
The settable instance ID defined in the EDS file of the adapter is displayed in the format of "OUT_ Instance ID". The instance ID is the identification No. of the cyclic (I/O) messages data defined in the adapter EDS file (Assembly object). When the EtherNet/IP Unit opens the connection to the adapter, data is sent according to the set RPI (communication period).
For assignment details of communication data of various adapters and other information, see appropriate unit manuals.

● Data size

The sent data size during cyclic (I/O) messages will be displayed in word.
If data size is an odd number of bytes, it is displayed in word after rounding up, cyclic (I/O) messages are executed in the form of odd number bytes. If data size is a variable adapter, the data size can be changed according to the "Parameter Setting" dialog box displayed after clicking the "Parameter Setting" button. For the parameter name and setting when changing data size, see appropriate adapter manuals.
If unidirectional connection in IN direction is set, 0 will be displayed.

● RPI (communication cycle)

Set communication data period (RPI) of OUT direction for cyclic (I/O) messages with the selected EtherNet/IP Device.
The setting range is 0.5 to 10000ms (unit: 0.5ms).
If "Consistent with IN" is checked, the RPI setting in OUT direction is the same as the RPI in IN direction. If unidirectional connection in IN direction is set, the communication period (16 times of RPI) of data send (Heartbeat) for communication status check is displayed.



Point

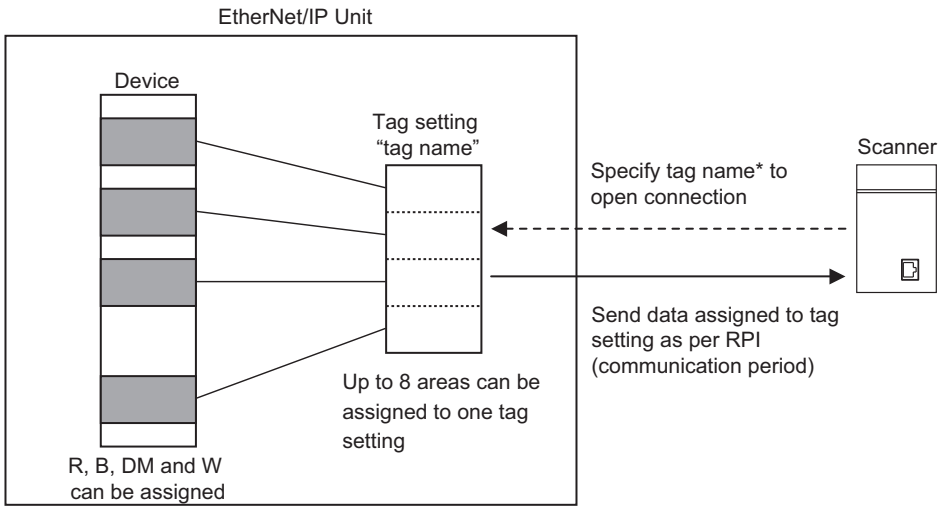
Certain EtherNet/IP Device may not support 0.5ms high-speed RPI (communication period) or may not support settings of 0.5ms units. In this case, please set the RPI supported by the unit according to EtherNet/IP Device manual.

Tag Setting

When EtherNet/IP Units send data to other scanners, the tag setting is required. When cyclic (I/O) messages are executed only between the EtherNet/IP Unit and the adapter, or data is only received from other scanners, the tag setting is not required.
Here, the tag setting for the EtherNet/IP Unit to send data to other scanners (other scanners receive data from the EtherNet/IP Unit) is described.

■ Tag setting

When EtherNet/IP Units send data to other scanners, the tag setting is required. When other scanners open a connection for the tag setting data (tag name) of the EtherNet/IP Unit, the EtherNet/IP Unit sends the device data assigned in the tag setting to the scanner in the set RPI (communication period).



* If the tag name cannot be specified for the scanner to which the EtherNet/IP Unit opens the connection, (instance ID) identification No. can also be specified to execute cyclic (I/O) messages.

When EtherNet/IP Units receive data from other scanners, the tag is set on the communication object scanner. When the EtherNet/IP Unit opens connection for the tag setting data (tag name) of the communication object scanner, the scanner sends data assigned on the tag setting to the EtherNet/IP Unit in the set RPI (communication period).
For connection setting of the tag setting data of other scanners, see "Connection point", page 4-33.

● Tag setting specification

- Up to 256 tag settings can be set for EtherNet/IP Units (64 for KV-NC1EP), according to connection settings.
- Devices assigned to the tag are R, B, DM, and W.
- Devices in up to 8 areas can be assigned to a tag.
- Total data size in a tag is 2 to 1448 bytes (1 to 724 words).
- Only the InputOnly application type can be opened for EtherNet/IP Unit tag setting.

Point

- **Up to 100 instance IDs (100 to 199) can be set for the tag setting.**
- **If data size of the tag setting exceeds the data size specified for connection establishment request of other scanners, data from the leading device assigned on a tag setting are sent according to the specified size.**
- **If the data size of a tag setting is less than the data size specified for connection establishment requests of other scanners, the connection establishment request will fail, and cyclic (I/O) messages cannot start.**
- **If a data size above 510 bytes is used, the connected scanner should support LargeForwardOpen (CIP option specification).**

■ Display of "Tag setting" dialog box

Display and setting of tag settings are described.

Click the EtherNet/IP Unit name in the scan list to display the "Tag setting" dialog box.

Other procedure

- Select the EtherNet/IP Unit from the scan list, and select "Tag setting" from the right-click menu.
- Select the EtherNet/IP Unit from the scan list, and click the "Tag setting" button in the "Unit setting" tab.
- Select "Setting(S)" ▶ "Tag setting(T)" from the menu.

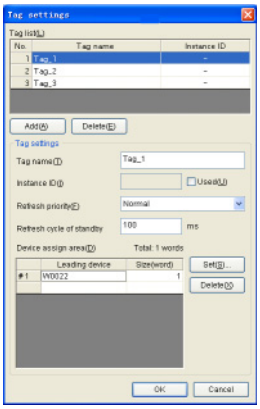


Tag List

Display the set tag setting in list.

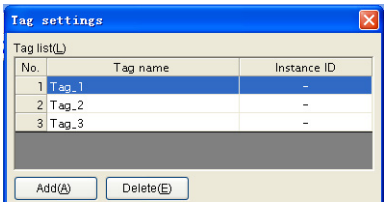
Tag setting

Execute communication setting and device assignment.



Items of tag setting

■ Setting items of tag list



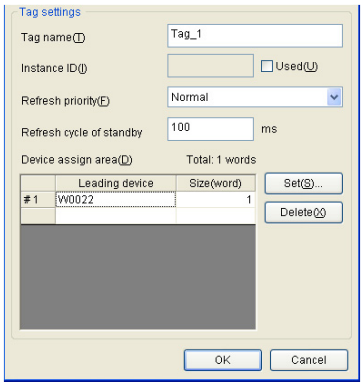
● Tag name/Instance ID

Display the set tag name and instance ID.

● “Add” button/“delete” button

Add/delete tag setting.

■ Setting items of tag setting



● Tag name

Set tag name.

Up to 48 case-insensitive, half-width characters can be set.

When adding the tag name, input Tag_(number) as default value.

"," should not be used in the tag name.

Japanese characters can be used in the tag name. However, the scanner which opens connection also supports Japanese, and encoding based on UTF-8 is required.

● Instance ID

For communication with a scanner which cannot process a tag name, set instance ID should be set.

After checking the "Enable" check box, the instance ID can be set.

For the instance ID to be set here, set scanner connection.

The setting range is 100 to 199. Default value is 100.

Point

If the instance ID is set, connections with a specified tag name cannot be opened.

● Refresh priority

Set the refresh priority for the CPU unit devices assigned in the tag setting data.

For device refresh, see "Refresh CPU Device and Communication Data", page 4-50.

Item	Description
Normal	Refresh according to the RPI (communication period) of cyclic (I/O) messages.
Priority	Refresh with priority over "Normal" according to the RPI (communication period) of cyclic (I/O) messages.
Top priority (each scanning)	Refresh upon each scanning of CPU unit.

For details of the selection items, see "Priority setting of refresh communication", page 4-54.

● Refresh cycle of standby process

Set the refresh period for the devices assigned to tag setting data before opening a connection from other scanners (standby). Before opening the connection, since the RPI (communication period) is not specified, refresh the device according to the set period and refresh priority. After opening the connection, the device will refresh according to the specified RPI and refresh priority. For device refresh, see "Refresh CPU Device and Communication Data", page 4-50.

The default value is 100(ms). The setting range is 1 to 10,000(ms).

● Device assign area

Set the device assigned to tag setting.

Devices that can be set include R, B, DM, and W, and up to 8 areas can be set.

Total data size in a tag is 724 to 1448 bytes (1 to 724 words).

Assignment area 1 to 8

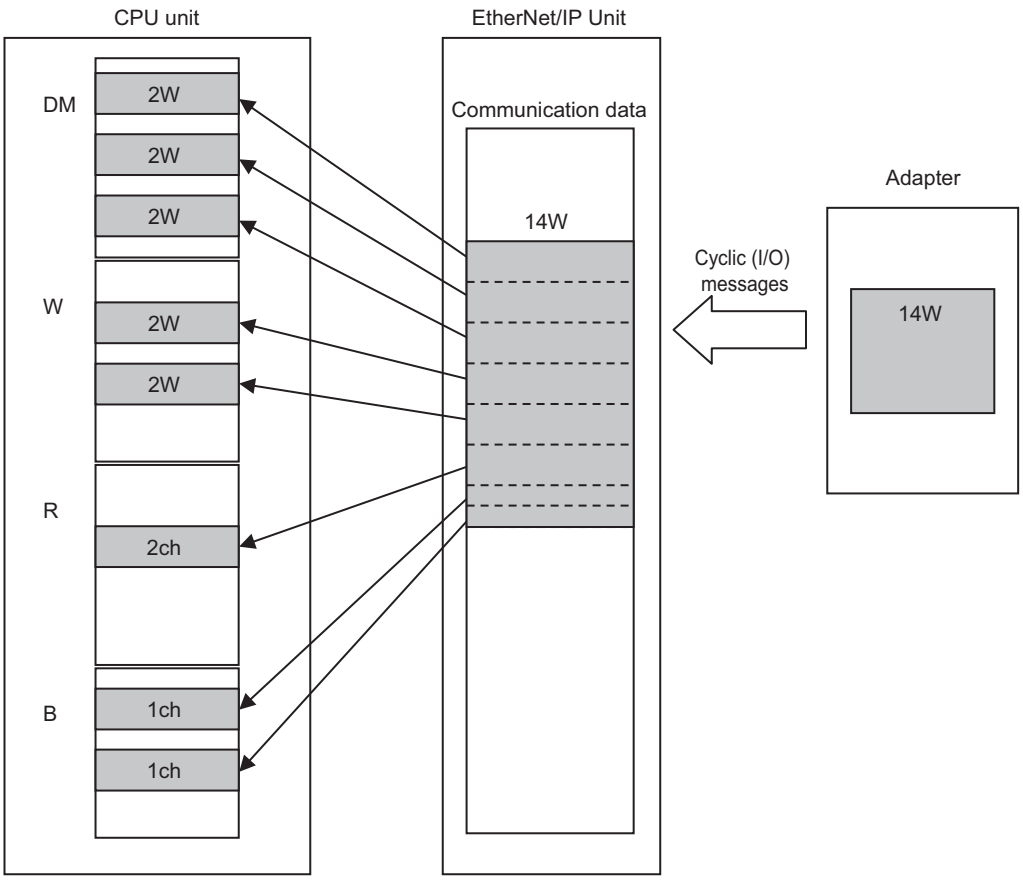
Item	Description
Leading device	Enter the leading device No. (even number) assigned to each area. The available devices are R, B, DM, and W. When using R and B, it is required to specify CH leading No. of relay.
Size (word)	Set the data size of each area in word.

Device Assignment for Cyclic (I/O) Messages Data

Sent/received cyclic (I/O) message data (input data, output data) stored in the EtherNet/IP Unit's buffer memory is assigned to the device.
Assignable devices include R, B, DM, and W. EtherNet/IP Settings of the KV STUDIO are used to assign the devices.

■ Device assignment area

Communication data can be assigned to up to 8 device areas for each connection.



Assignable devices R, DM, B and W
Up to 8 areas can be assigned

Reference Communication data of a connection can be divided and assigned to multiple devices, so that the bit area can be assigned to relay devices R and B in advance, the word area can be assigned to word devices DM and W.

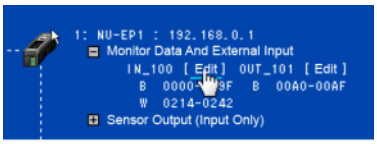
■ Assignment method of CPU device

CUP devices used for sending and receiving communication data in cyclic (I/O) messages can be assigned through the "Device assignment setting" dialog box of the Connection Setting.

● Display of "Device Assignment Setting" dialog box

Click the "Device assignment" button to display the "Device assignment setting" dialog box.

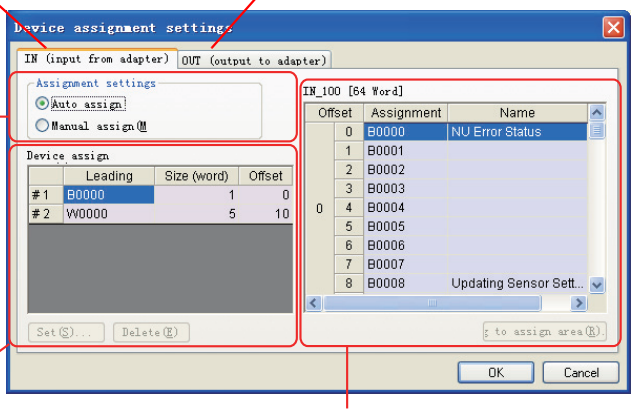
Other procedure Click "edit" in scan list.



IN (input from adapter) tag
Used for data in the receive direction.

OUT (Output to adapter) tag
Used for data in the send direction.

Assignment setting
Select the assignment method of device.



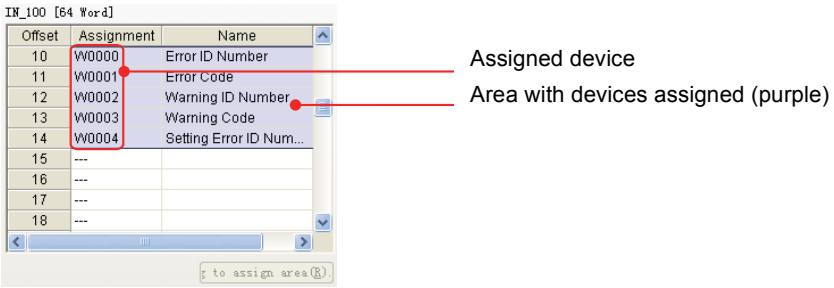
Device assignment area
Enter the device to be assigned. A maximum of 8 areas can be assigned, and the device can be R, B, DM, and W.

Communication data area
The sent/received data during cyclic (I/O) messages. Only a portion of the area can be assigned.

Reference During the configuration of the EtherNet/IP Device, communication data is assigned automatically to the devices. The leading No. of the device can be set with the "Auto assignment setting", or "Assignment bit device leading No.", "Assign word device leading No." in the Unit Editor.
If the "Automatic assignment setting" is set to "Enable (Default value)", devices B (bit) and W (word) are used.

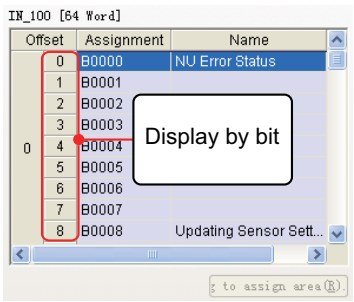
Communication data area

Sent/received data of the EtherNet/IP Device in cyclic (I/O) messages are displayed in this area.
In areas with CPU unit devices assigned, the background color is purple.

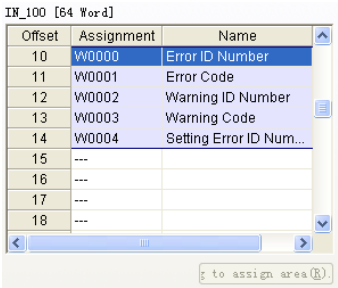


If the type (bit, word) of communication data is defined in the EtherNet/IP Device from KEYENCE, the display mode of the communication data varies with data type.

- Bit



- Word



Reference

In areas where the data type is bit, the “assign bit device leading no.” settings of the unit editor will be the (default value: B) device, in areas where the data type is word it will be the (default value: W) device.

● How to change/add device assignment

The following describes the procedures for changing the device assignment manually using the "Device assignment setting" dialog box, and dividing into several areas.
Here, the manual device assignment after setting deletion is described.

Reference The number of CPU unit and EtherNet/IP Unit refresh devices can be reduced by assigning part of the communication data to the device.

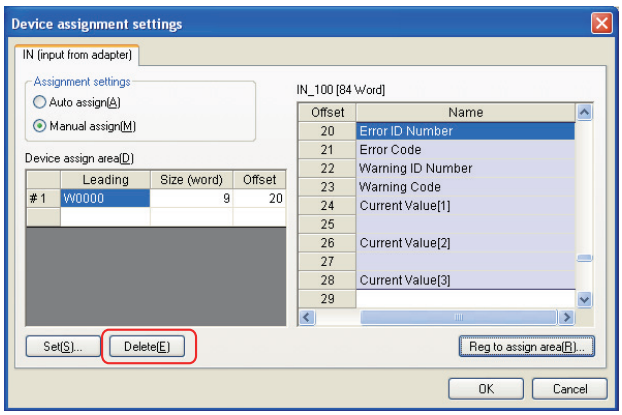
1 Check "Manual assignment".



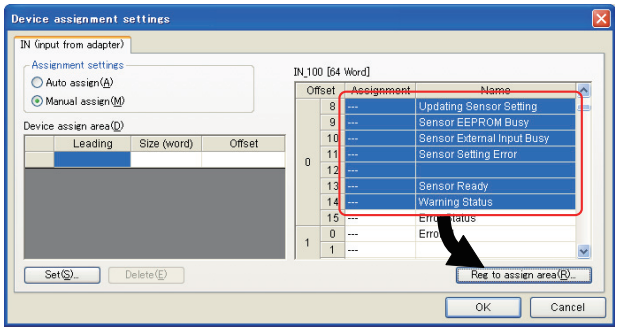
Point

If the "Auto assignment" is checked, the auto assignment will be executed again. If auto assignment is checked again, for assignable consecutive free devices, devices may be assigned to an area different from that before execution.

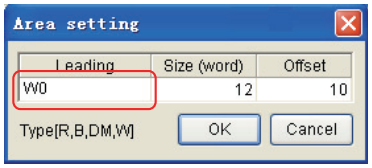
2 Use the "Delete" button to delete all automatically assigned areas.



3 **Select the communication data assigned to the devices in the communication data area, and click the "Reg to assign area" button.**



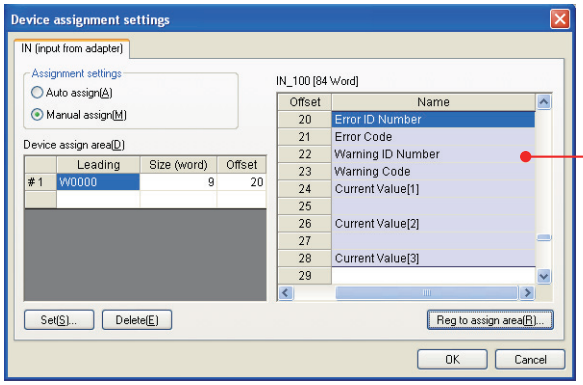
4 **In the "Area setting" dialog box, enter the leading device, and click the "OK" button.**



Point

Devices usable include R, B, DM, and W.

5 **The setting will be added into the assignment area.**

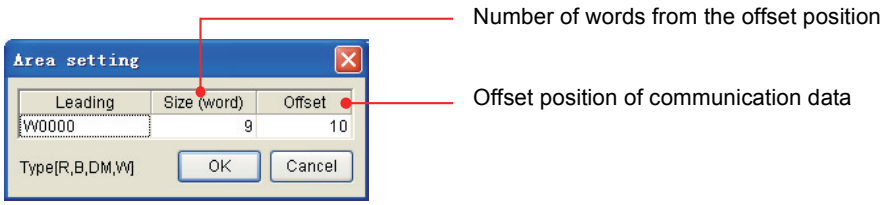


Area where CPU unit devices are assigned

Please repeat the steps 3 and 4 as required.

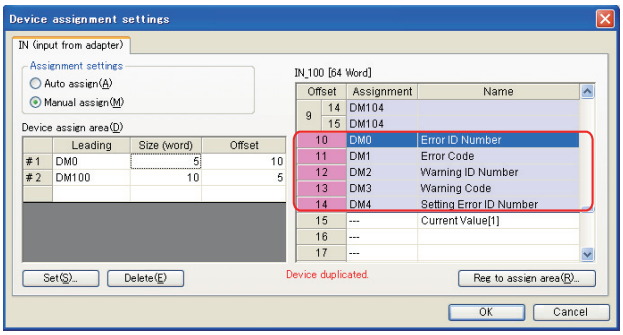
6 **If change is required, various settings of the assignment area can be changed.**

Enter the value in the items of the assignment area, or click the "Setting" button to display the "Area setting" dialog box. Change leading device, size (word), and offset.



Point

In areas with multiple assigned communication data, the, background color is pink.



Point

For EtherNet/IP Devices from other companies, or EtherNet/IP Devices from KEYENCE with an undefined communication data type, an automatically assigned device can be selected from the bit device and word device.

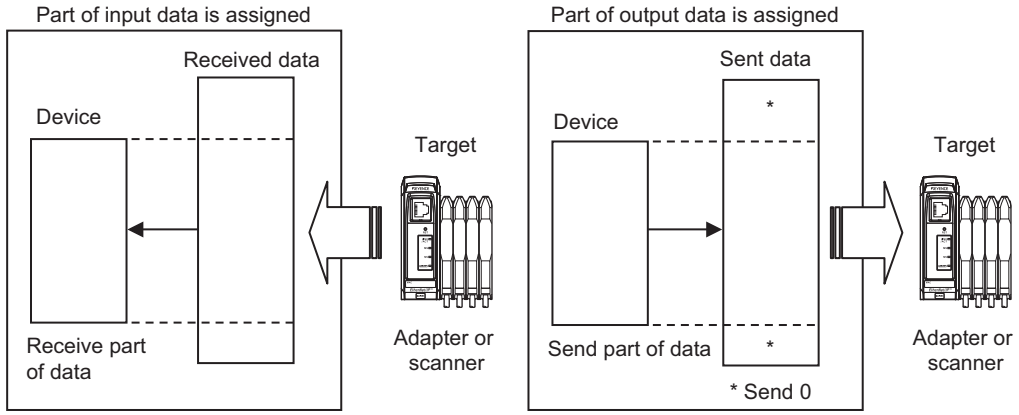


■ Precautions on device assignment

● Assignment of part of communication data

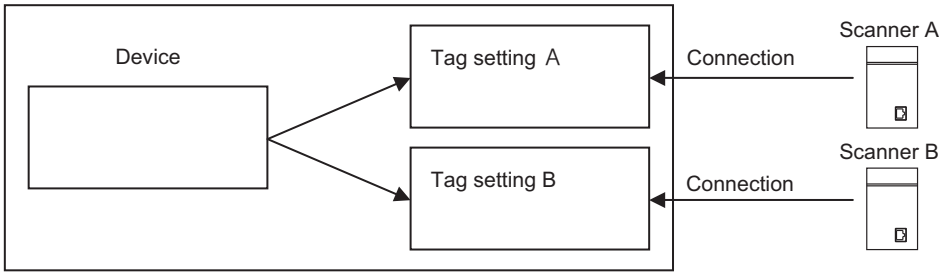
Only a part of the communication data can be assigned to the device.

If only a part of the output data is assigned to the device, communication data not assigned to the device will be sent as 0.



● Duplicate device assignment of tag setting

Data in the same device area can be assigned to multiple tag settings. It is used when different RPI (communication period) is used to send data in the same area to multiple scanners.

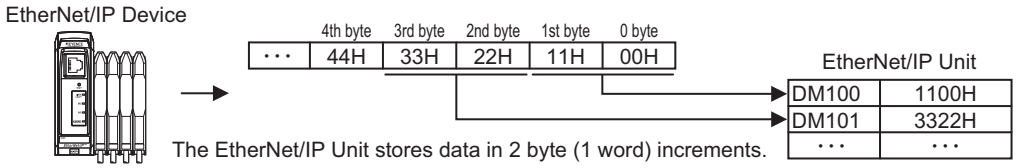


● Storage format of communication data

In EtherNet/IP communication, sent/received data is processed as byte array in Little Endian format.

The EtherNet/IP Unit stores in word increments the data received in byte increments, in the sequence of lower bytes => upper bytes.

If the communication data size is an odd number of bytes, the last byte is stored in the lower bytes of the device, 00H is stored in the upper.



Therefore, the EtherNet/IP Device (adapter or scanner) and sent/received data are stored in the devices of assignment area's devices as follows.

Storage example (1)

Data of EtherNet/IP Unit

Data	Value	Description
0 byte	11H	1 byte (8 bits)
1st byte	22H	1 byte (8 bits)
2nd byte	11H	2 bytes (1 word, 16 bits)
3rd byte	22H	2211 (H)
4th byte	11H	4 bytes (2 word, 32 bits)
5th byte	22H	44332211 (H)
6th byte	33H	
7th byte	44H	
8th byte	11H	8 bytes (4 word, 64 bits)
9th byte	22H	
10th byte	33H	
11th byte	44H	
12th byte	55H	
13th byte	66H	
14th byte	77H	
15th byte	88H	

EtherNet/IP communication

EtherNet/IP Unit device value

Device	Value	Description
DM100	2211H	Set 0 byte to lower byte Set 1st byte to upper byte
DM101	2211H	1 word
DM102	2211H	Lower word (16 bits)
DM103	4433H	Upper word (16 bits)
DM104	2211H	
DM105	4433H	
DM106	6655H	
DM107	8877H	

Storage example (2) when storing data of one word from an odd number of bytes

Data of EtherNet/IP Unit

Data	Value	Description
0 byte	11H	1 byte (8 bits)
1st byte	22H	1 byte (8 bits)
2nd byte	33H	1 byte (8 bits)
3rd byte	11H	2 bytes (1 word, 16 bits)
4th byte	22H	2211 (H)

EtherNet/IP communication

EtherNet/IP Unit device value

Device	Value	Description
DM100	2211H	Set 0 byte to lower byte Set 1st byte to upper byte
DM101	1133H	Set 2nd byte to lower byte Set 3rd byte to upper byte*
DM102	0022H	Set 4th byte to lower byte* Store 00H in upper byte

* 16-bit data is divided for storage.

Storage example (3) character string data

Data of EtherNet/IP Device

Data	Value	Description
0 byte	"A":41H	Character string data "ABCDEF"
1st byte	"B":42H	
2nd byte	"C":43H	
3rd byte	"D":44H	
4th byte	"E":45H	
5th byte	"F":46H	

EtherNet/IP communication

EtherNet/IP Unit device value

Device	Value	Description
DM100	"BA" :4241H	Character string data "BADCFE"
DM101	"DC" :4443H	ASCII character string data is inversed every 1 byte.
DM102	"FE" :4645H	

For EtherNet/IP communication data type and device storage format,
see "Data Type and Device Storage Mode", page 4-172.

Reference If the following command is used, the CIP character string type data and offset data (in byte) can be processed easily.

"BYLMOV command (byte array move (L->H))" KV-5500/3000/1000 Command Reference Manual
"BYLMOV command (byte array move (H->L))" KV-5500/3000/1000 Command Reference Manual
"RCPSASC command (Inverse conversion of CIP character string type data)", page 4-184
"CPSASC command (Conversion of CIP character string type data)", page 4-186

Refresh CPU Device and Communication Data

Sent/received data (input data, output data) of cyclic (I/O) messages and assigned devices of CPU unit will be refreshed automatically. The specific command for refreshing cyclic (I/O) messages data can be used to refresh the value of buffer memory and the CPU device at any time.

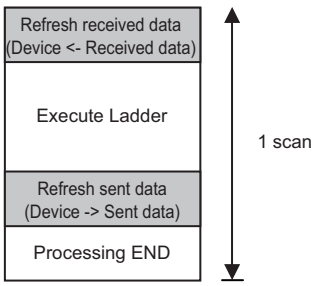
"RFSCI command (cyclic (I/O) messages input refresh)", page 4-70

"RFSCO command (cyclic (I/O) messages output refresh)", page 4-74

■ Auto refresh

Auto refresh for the communication data and the device is executed before and after the Ladder operation.

[Execution timing of auto refresh]



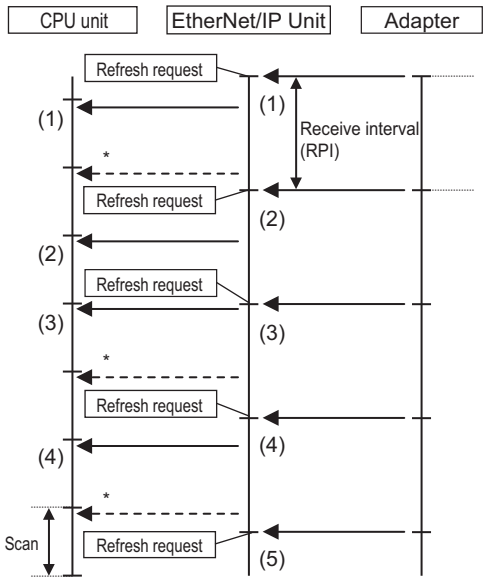
Point

CPU unit can also execute auto refresh in PROG mode.

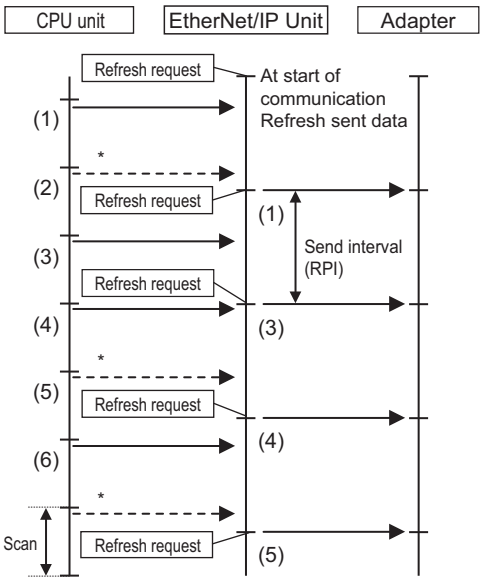
Except for when the refresh priority is "Top Priority (each scan)", CPU refresh request occurs when the EtherNet/IP Unit executes data send/receive according to RPI (communication period), and refresh is executed before and after the next ladder operation.

"Priority setting of refresh communication", page 4-54

[Auto refresh of received data]



[Auto refresh of sent data]



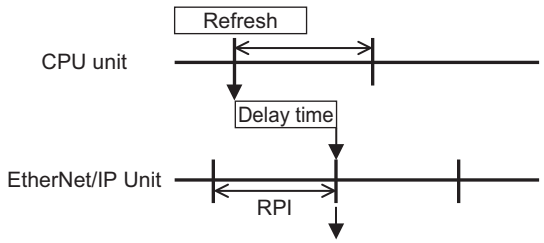
* Refresh is not executed.

■ Delay time of send/receive data

Before refresh, the delay time of the EtherNet/IP Unit communication data varies with the scan time and RPI (communication period conditions).

● Delay time of send data

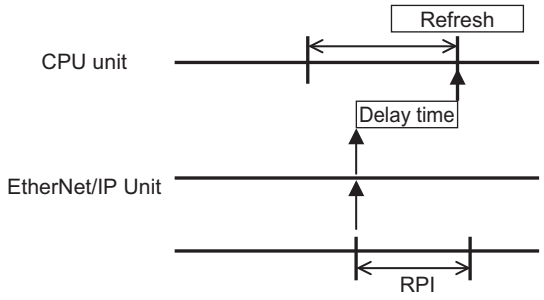
Before the KV-EP21V sends the refreshed communication data, the longest delay time is as follows.



Condition	The longest delay time of send data (CPU->EtherNet/IP Unit)
Scan time < RPI	RPI (Scan time x 4 >= RPI) The larger of scan time x 4 or RPI x 1/16 (scan time x 4 < RPI)
Scan time ≒ RPI	Scan time (RPI)
Scan time > RPI	RPI

● Delay time of receive data

Before the communication data received by the KV-EP21V is refreshed, the longest delay time is as follows.



Condition	The longest delay time of receive data (EtherNet/IP Unit->CPU)
Scan time < RPI	Scan time
Scan time ≒ RPI	Scan time (RPI) x 2
Scan time > RPI	RPI

● Refresh timing of tag setting data

The sent data set by the tag settings (or instance ID) of the EtherNet/IP Unit assigned to the device will refresh according to the timing below. (Excluding the send data delay time caused by scan time and RPI conditions.)

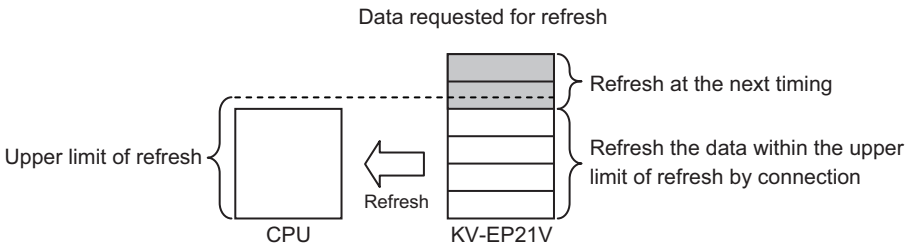
Conditions	Description
When powered on When changing settings data	Refresh will occur when turning power on or when changing settings data. Before refresh is completed, connection establishment request of other scanners will not be accepted.
Standby	Data at the selected interval in "standby refresh period (ms)" before the connection is opened or when communication is being cut off will refresh.
Communication in progress	After opening the connection, refresh the data at the selected RPI (communication period) will refresh.

■ Upper limit of refresh (refresh communication bandwidth limit)

The KV-EP21V may perform data communication of up to 24k words, the KV-5500 of up to 16k words, and the KV-NC1EP of up to 8k words. Therefore, when several connections are refreshed at the same time, refresh time will increase, and will influence the scan time.

After setting "Upper Limit of Refresh" of the KV STUDIO Unit Editor, if refresh quantity of a single pass exceeds "Upper Limit of Refresh", the excessive part will be refreshed after the next pass, so as to alleviate the influence on scan time.

"Upper limit of refresh (word/scan)", page 3-11



● When the operation is set at the Upper Limit of Refresh

When the EtherNet/IP Unit RPI sent/received number of data exceeds the Upper Limit of Refresh, data in the upper limit will be refreshed in the connection unit. For reserved refresh at Upper Limit of Refresh, in the next refresh, priority refresh is set to "Priority" connection.

Refresh request of reserved data is different from RPI communication timing, minimum interval is 0.5ms, therefore, even if RPI communication timing does not occur, reserved data will also be refreshed.

Even if the connected data size exceeds the Upper Limit of Refresh, refresh will occur in the connection unit.

Example1) Upper limit of refresh = 0 (invalid) * scan time = 0.5ms
All data is refreshed during data update based on RPI.

Connection	RPI (ms)	Data size	Elapsed time (ms)													
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5
A	1	10	10		10		10		10		10		10		10	
B	2	20			20				20				20			
C	3	30					30						30			
Number of refresh words (W)			10	0	30	0	40	0	30	0	10	0	60	0	10	0

Example2) Upper Limit of Refresh = 40 * scan time = 0.5ms
During data update based on RPI, data beyond 40 words will be refreshed at next update.

Connection	RPI (ms)	Data size	Elapsed time (ms)													
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5
A	1	10	10		10		10		10		10		10		10	
B	2	20			20				20				20			
C	3	30					30						(30)	30		
Number of refresh words (W)			10	0	30	0	40	0	30	0	10	0	30	30	10	0

30 words of data will be refreshed at next update (when communication occurs in A->B->C sequence)

Example3) Upper limit of refresh = 10 * scan time = 0.5ms
During data update based on RPI, data beyond 10 words will be refreshed at next update for each connection.

Connection	RPI (ms)	Data size	Elapsed time (ms)													
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5
A	1	10	10		10		10		10		10		10		(10)	10
B	2	20			(20)	20			(20)	20			(20)	20		
C	3	30					(30)	30					(30)	(30)	30	
Number of refresh words (W)			10	0	10	20	10	30	10	20	10	0	10	20	30	10

Refresh at next update (when communication occurs in A->B->C sequence)

Refresh at next, and next next update (when communication occurs in A->B->C sequence)

■ Priority setting of refresh communication

To refresh each connection setting, priority setting is available.

Three priority settings are available, setting can be executed in "Connection setting" dialog box or "Tag setting" dialog box of EtherNet/IP Setting.

"Refresh priority" (Connection setting), page 4-30

"Refresh priority" (Tag setting), page 4-41

- **Refresh priority**

Item	Description
Top Priority (each scanning)	Refresh EtherNet/IP Unit communication data at each scan time. "Top Priority" connection setting is not included in the upper limit of refresh. Point **Not synchronous with RPI timing of cyclic (I/O) messages, refresh upon each scanning is not synchronous, so data synchronism for each connection is not guaranteed. However, synchronism of initial two even numbered words of data can be ensured.**
Priority	Refresh communication data according to RPI timing of cyclic (I/O) messages, thus synchronism for each connection is executed. "Priority" connection setting is included in the object of upper limit of refresh, if refresh beyond the upper limit is reserved, at next refresh, "Normal" connection setting will be prioritized.
Normal	Refresh communication data according to RPI timing of cyclic (I/O) messages, ensure synchronism of the connection unit. "Normal" connection setting is included in the object of upper limit of refresh, if refresh beyond the upper limit is reserved, at next refresh, "Priority" connection setting will be prioritized.

- **Priority during the operation**

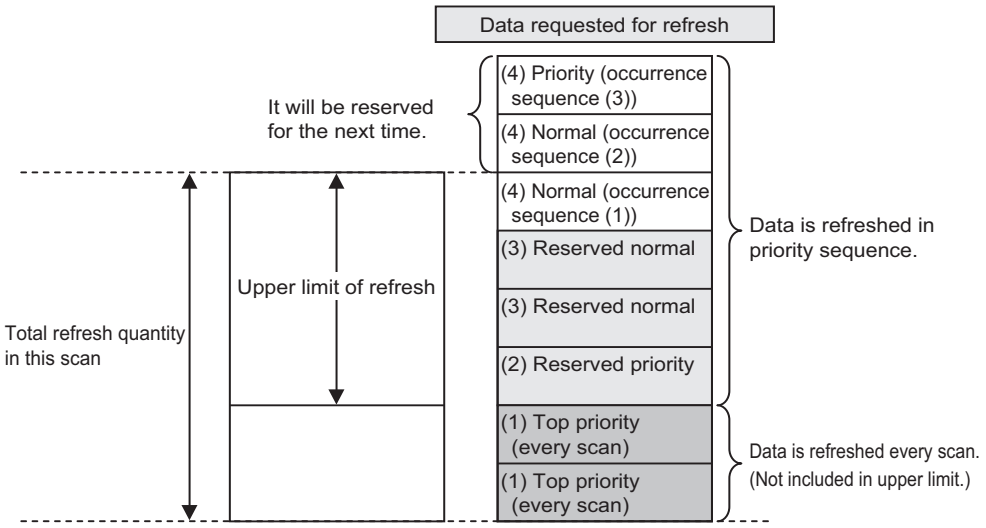
(1) Top priority (each scanning) — Priority level High

(2) Reserved priority

(3) Reserved normal

(4) Communication sequence of priority and normal* — Priority level Low

* Communication data within the upper limit of refresh is refreshed according to occurrence sequence, irrelevant to the setting of "Priority", or "Normal". Communication data beyond upper limit of refresh will be reserved to refresh at the next time according to the "refresh priority".



■ Refresh based on command

Use RFSCI command (cyclic input refresh), or RFSCO command (cyclic output refresh) to update (refresh) a part or all of the communication data at any time.

When refreshed with a command, communication data between the CPU unit device and the EtherNet/IP Unit will transfer, and cyclic (I/O) messages will not be executed at the command time.

"RFSCI command (cyclic (I/O) messages input refresh)" (page 4-70)

"RFSCO command (cyclic (I/O) messages output refresh)" (page 4-74)

Calculation and Restriction of Communication Load (Load Factor)

■ Communication load (load factor)

Load factor refers to the ratio of the maximum number of data packets (hereinafter referred to as the allowable communication bandwidth of cyclic (I/O) messages) that can be sent/received by the EtherNet/IP Unit in 1 second, and the actual number of data packets being used. In the calculation of load factor, data packet other than cyclic (I/O) messages or unnecessary data packet received are not included. The load factor of cyclic (I/O) messages in operation can be checked by current value of cyclic (I/O) messages the load factor in the buffer memory or "Communication rate monitor in Unit Monitor of KV STUDIO". Even if load factor of cyclic (I/O) messages reaches 100%, other Ethernet applications also can run.However it will be delayed.

In case functions other than cyclic (I/O) messages are used at the same time, see "Communication Load Factor Estimate when Using Peripheral Function", page 4-60.

Reference

- For communication load factor check during design of cyclic (I/O) messages, see "5-13 Calculate Cyclic (I/O) Messages Load Factor", page 5-67.
- For communication load check of cyclic (I/O) messages in operation and functions other than cyclic (I/O) messages, see "Communication speed monitor", page 15-5.

■ During Load factor calculation timing

Load factor is the sum of the load factor of the originator during operation (KV-EP21V opens connection for adapter or scanner) and load factor of the target unit during operation (other scanners open connection for EtherNet/IP Unit tag setting).

● Load factor calculation timing during operation of originator

Load factor is calculated and updated at connection establishment request (start, restart, stop). The node with cyclic (I/O) messages stop node table OFF is a calculation object, so connection setting of adapters or scanners that are not connected will also be calculation objects.

Point

RPI is used to calculate load factor. If RPI unsupported by EtherNet/IP Device is set, API (Actual Packet Interval) different from RPI is used as communication period, so load factor cannot be calculated correctly. Please set the RPI supported by the unit according to EtherNet/IP Device manual.

● Load factor calculation timing during operation of the target unit

During communication standby, the load factor is calculated based on the standby refresh period in the tag setting. Load factor is recalculated and updated at connection/disconnection, or time out from other scanners.

Communication direction	Normal communication	Standby
Send direction	Calculate based on RPI*1	Calculate based on standby refresh period
Receive direction	Calculate based on RPI*2	Calculate based on 16 times of standby refresh period

*1 RPI (communication period) of other scanners. In case of the standby refresh period < RPI, standby refresh period is used for calculation.

*2 RPI (communication period) of other scanners. In case of 16 times of standby refresh period < RPI, 16 times of standby refresh period is used for calculation.

Point

For the calculation of load factor, calculation is based on the assumption that an 100Mbps Ethernet switch will be used. When the 10Mbps Ethernet switch or repeater hub (half duplex) is used, even if the load factor is within 100%, unstable cyclic (I/O) messages may occur.

■ Restrictions for load factor beyond 100%

When the load factor exceeds 100%, the requested cyclic (I/O) messages cannot start.

● Restrictions when originator is in operation (the end opening connection)

- **At startup of unit (Auto cyclic (I/O) messages start is set to "Enable")**
  When total load factor of the connection setting and tag setting exceeds 100%, the cyclic (I/O) messages overload error occurs (cyclic (I/O) messages overload relay ON), the cyclic (I/O) messages cannot start.
- **At startup of unit (Auto cyclic (I/O) messages start is set to "Disable")**
  Load factor of each connection is calculated at the time of cyclic (I/O) messages restart request relay ON.

- **At cyclic (I/O) messages restart/stop**
  Load factor is calculated at the time of cyclic (I/O) messages restart request/stop request. If the load factor calculated by adding to communication traffic of all object nodes at cyclic (I/O) messages restart request exceeds 100%, turn overload relay will ON, communication with all object nodes cannot restart. In this case, the unit error will not occur, while stopped the restart complete relay will turn on, and the error node table will not be set. Communication of previous cyclic (I/O) messages nodes will continue.

● Restrictions when target unit is in operation (connection is established)

Load factor is updated at the time of connection, disconnection, or time out from other scanners. When using Forward Open from another scanner to request to establish connection, if the load factor calculated by adding the communication traffic and calculated based on the specified RPI exceeds 100%, connection establishment request will not be accepted. In this case, the EtherNet/IP Unit returns to General Status (01H: Connection Failure), and Addition Status (0302H: no network bandwidth). The unit error will not occur on the EtherNet/IP Unit, so the connection establishment result of the originator scanner should be checked.

■ Calculation method of load factor

The load factor is the number of sent/received data packets (pps) within 1s for each connection setting is calculated based on the RPI and data size, the ratio of the total value of allowable communication bandwidth of cyclic (I/O) messages will be displayed. Calculation method for the sending end is the same as the receiving end.

If load factor exceeds 100%, it should be adjusted to be within 100% by increasing RPI (communication period) of each connection setting etc.

● Calculation steps

Calculation step (1) calculate number of sent/received data packets (pps) within 1s based on the RPI.
Calculation result (1) = 1,000 / RPI [ms]

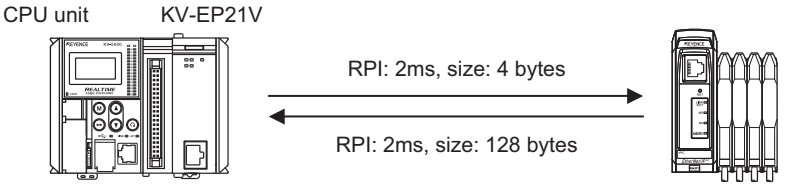
Calculation step (2) if data size per data packet exceeds 505 bytes, calculation result (1) is doubled.
Above 505 bytes: calculation result (2) = calculation result (1) x 2
Below 504 bytes: calculation result (2) = calculation result (1)

Calculation step (3) aggregate calculation result (2) of each connection and send/receive.
Calculation result (3) = total of calculation result (2)

Calculation step (4) calculate the ratio (load factor) of allowable communication bandwidth of cyclic (I/O) messages.
KV-EP21V : load factor = calculation result (3) / 12,000 x 100 [%]
KV-5500 : load factor = calculation result (3) / 10,000 x 100 [%]
KV-NC1EP : load factor = calculation result (3) / 6,000 x 100 [%]

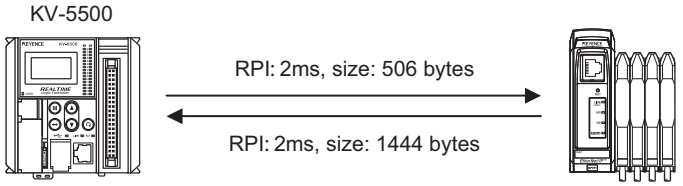
● Calculation example

Calculation example 1) the KV-EP21V when communicating with one adapter, and with data size below 504 bytes



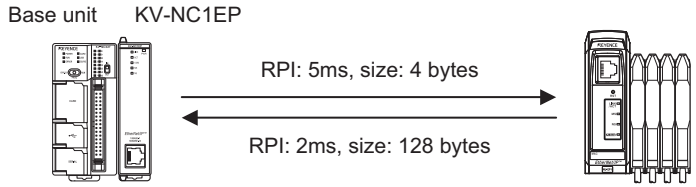
Load factor = ((1,000 ÷ 2) + (1,000 ÷ 2)) ÷ 12,000 x 100
= 8.33%

Calculation example 2) the KV-5500 when communicating with one adapter, and with data size above 505 bytes



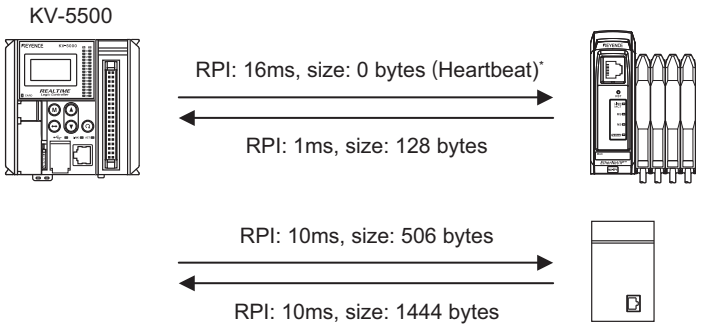
Load factor = ((1,000 ÷ 2 x 2) + (1,000 ÷ 2 x 2)) ÷ 10,000 x 100
= 20.00%

Calculation example 3) 1 EtherNet/IP Unit adapter communicating 504 bytes of data or less



Load factor = ((1,000 ÷ 5) + (1,000 ÷ 2)) ÷ 6,000 x 100
= 11.66%

Calculation example 4) the KV-5500 when communicating with two adapters or scanners



Load factor = ((1,000 ÷ 16) * + (1,000 ÷ 1) + (1,000 ÷ 10 x 2)
+ (1,000 ÷ 10 x 2)) ÷ 10,000 x 100
= 14.63%

* Heartbeat (communication for check communication status) executed when data direction not set is also calculated.

● Calculation method in case of COS (Change of State)

If COS (Change of State) is set as send trigger in connection setting, communication traffic is calculted based on communication period of RPI (communication period) x 1/4.

For COS (Change of State), see 🕮 "Send trigger", page 4-35.

Communication Load Factor Estimate when Using Peripheral Function

The communication rate of peripheral functions* of the EtherNet/IP Unit may vary with the cyclic (I/O) messages load factor. If the communication rate of the peripheral function has priority, the cyclic (I/O) messages setting should be changed to reduce load factor.

The following describes the communication load factor estimate when peripheral function is used.

* For example, simple PLC link, explicit messages, sensor application, higher-lever link function, mail send/receive, FTP server, FTP client, Ethernet communication with display.

■ Cyclic (I/O) messages load factor and communication rate (device read rate) when the KV COM+ Library is used

Our data acquisition software KV COM+ Library is a tool used to read/write the CPU unit device.

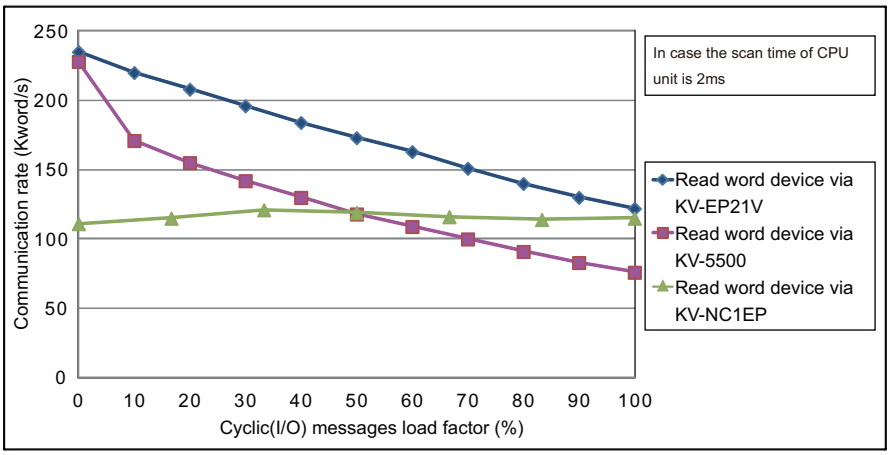
Communication rate (Kwords/s) of devices between KV COM+ Library and CPU unit varies with CPU unit scan time, cyclic (I/O) messages load factor, and use of other functions.

The influence on communication rate of cyclic (I/O) messages load factor is shown in the figure below.

The figure below shows the relationship between communication rate and cyclic (I/O) messages load factor when KV COM+ Library is used to read the word device continuously.

When scan time of the CPU unit connected with EtherNet/IP Unit is 2ms

Cyclic (I/O) messages load factor and communication rate (device read rate) when the KV COM+ Library is used

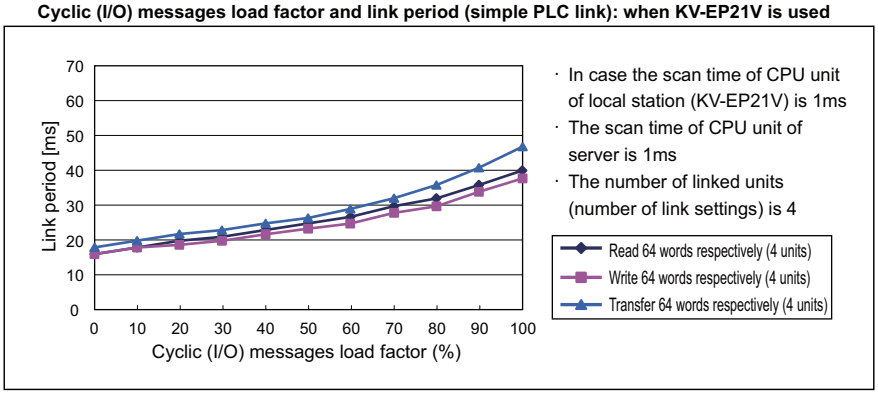


■ Cyclic (I/O) messages load factor and link period

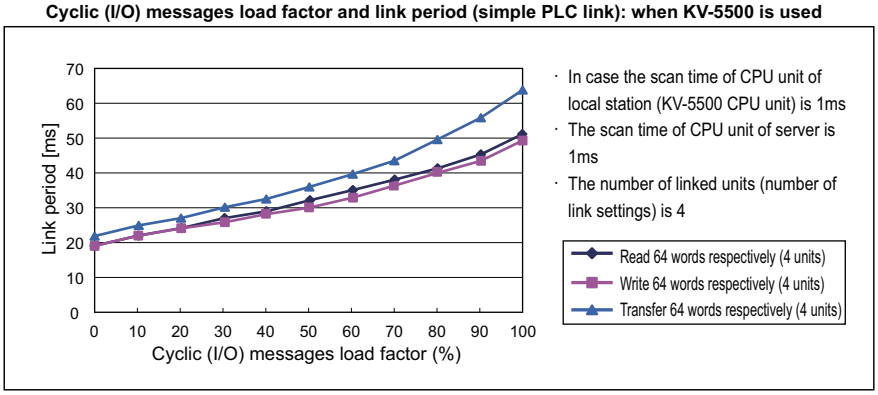
The link period of the simple PLC link function of the EtherNet/IP Unit varies with the number of link settings, transferred data size, CPU unit scan time, cyclic (I/O) messages load factor, and use of other peripheral functions. Sometimes communication is unavailable based on the set update interval time.
To set the update interval time of the simple PLC link function, see the figure below.
For the setting of simple PLC link, and the influence of the number of link settings etc on link period, see "Chapter 13 SIMPLE PLC LINK FUNCTION".
In actual application, please use Unit Monitor of KV STUDIO to set correct the value after checking the link period.

For the MC protocol server unit (KV-EP21V, KV-5500 or KV-NC1EP), when the bit device/word device per setting is set to 64 words (total 128 words) respectively, the relationship between link period and cyclic (I/O) messages load factor is shown in the figure below.

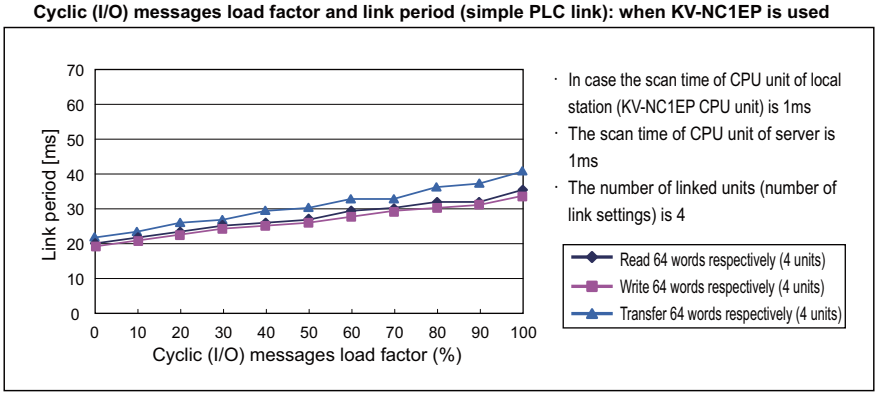
Cyclic (I/O) messages load factor and link period (simple PLC link): when KV-EP21V is used



Cyclic (I/O) messages load factor and link period (simple PLC link): when KV-5500 is used

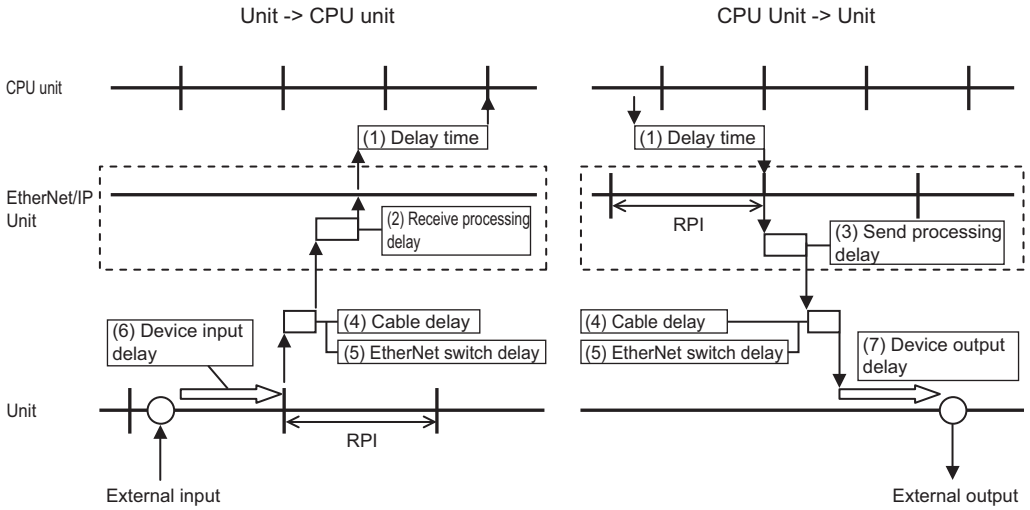


Cyclic (I/O) messages load factor and link period (simple PLC link): when KV-NC1EP is used



Cyclic (I/O) Messages Communication Time (Delay Time)

The following describes cyclic (I/O) messages communication time (delay time) between the EtherNet/IP Unit and the EtherNet/IP Device.



(1) Delay time

For the delay time of data send/receive between CPU units and EtherNet/IP Units, see "Delay time of send/receive data", page 4-51.

(2) Receive processing delay

The following delay time occurs when receiving communication data from each unit.
Maximum delay time 0.2 + (0.04 x number of connections) (ms)

(3) Send processing delay

When sending communication data to each unit, the maximum 100ms delay time occurs.

(4) Cable delay

The maximum value of the cable delay is generally below 1ms. Compared with other delays, the influence of cable delay can be ignored.

(5) Ethernet switch delay

Ethernet switch delay is generally about (number of connections x 0.13) ms, which will increase in case of cascade connection. For more information, see appropriate Ethernet switch manual.

(6) EtherNet/IP Device input delay / (7) EtherNet/IP Device output delay

For unit input/output processing time, see appropriate unit manual.

Devices and Programs used in Cyclic (I/O) Messages

■ Devices used in cyclic (I/O) messages

● Relay

n: Leading relay No.

Relay No.	Name	Function	R/W
n +0 to 2	Reserved for system	Unavailable	-
n +3	I/O msg stop req	OFF->ON: stop all cyclic (I/O) messages for the nodes specified in cyclic (I/O) messages stop request node table. • Stop request will not be executed before IP address active relay is ON. • If it is ON, but cyclic (I/O) messages restart processing is in progress, stop processing is not executed before completion of restart processing. • If both it and cyclic (I/O) messages restart request relay are ON, stop processing is executed firstly, then restart processing is executed.	W
n +4	Reserved for system	Unavailable	-
n +5	Restart I/O msg req	OFF->ON: restart all cyclic (I/O) messages for the nodes specified in cyclic (I/O) messages restart request node table. • Restart request will not be executed before IP address active relay is ON. • If it is ON, but cyclic (I/O) messages stop processing is in progress, restart processing will not be executed before stop processing is completed. • If both it and cyclic (I/O) messages stop request relay are ON, after stop processing is completed, restart processing is executed.	W
n +6 to 15	Reserved for system	Unavailable	-
n +1000	Reserved for system	Unavailable	-
n +1001	I/Omsg All node in communication	ON: It will be ON if cyclic (I/O) messages with all registered nodes are successful, and devices are refreshed. OFF: It will be OFF if normal cyclic (I/O) messages is unavailable for more than 1 registered node. • It will be OFF when there is no node registered for cyclic (I/O) messages.	R
n +1002	I/O msg All nodes stopping	ON: it will be ON when cyclic (I/O) messages with all registered nodes is in stop status. • It will be OFF when there is no node registered for cyclic (I/O) messages.	R
n +1003	I/O ms stopped	ON: it will be ON after the requested processing is completed. ON->OFF: it will be OFF when request relay is ON->OFF.	R
n +1004	Reserved for system	Unavailable	-
n +1005	I/O ms restarted	ON: it will be ON after accepting the request. ON->OFF: it will be OFF when request relay is ON->OFF. • To restart, overload relay is ON, even if communication is unavailable, the complete relay is also ON. Normally established connection can be checked in cyclic (I/O) messages normal node table.	R
n +1006	Reserved for system	Unavailable	-
n +1007	Adapter error (all)	It is enabled when the KEYENCE adapter is used. OFF->ON: it will be ON when error occurs on any adapter.	R

Relay No.	Name	Function	R/W
n +1008	Adapter warning (all)	It is enabled when the KEYENCE adapter is used. OFF->ON: it will be ON when warning occurs on any adapter.	R
n +1009	I/O ms overload	ON: when processing the cyclic (I/O) messages restart request, and load factor exceeds 100% after adding the specified node is ON. If Cyclic (I/O) messages restart complete relay is also ON, but communication of the specified node will not start. Communication of the previous cyclic (I/O) messages nodes will continue. ON->OFF: in case load factor is bellow 100%, it will be OFF if cyclic (I/O) messages stop complete relay, and restart complete relay are ON again.	R
n +1010 to 1015	Reserved for system	Unavailable	-

● DM

N: Leading DM No.

DM No.	Name	Function	R/W
N +20	Error code	Errors occurring in the EtherNet/IP Unit and the detailed error code are stored.	R
N +21	Specific error code		R
N +22	Error node address	If the cyclic (I/O) messages error occurs, node address (slot No.), connection No., and vendor ID of the error target unit are stored.	R
N +23	Error slot No.		R
N +24	Error connection No.		R
N +25	Error vendor ID		R
N +26 to 41	I/O msg normal node table*1	ON: It will be ON after connections to all nodes are established, and the first refresh is completed. • OFF when restarting based on reset service or setting change.	R
N +42 to 57	I/O msg stop node table*1	ON: ON after communication stop processing is completed for all nodes. • It will be OFF when restarting based o reset service or setting change .	R
N +58 to 73	Adapter error table*1	It is enabled when the node is the KEYENCE adapter. ON: It will be ON when error occurs on the adapters. • Update period is 100ms.	R
N +74 to 89	Adapter warning table*1	It is enable when the node is the KEYENCE adapter. ON: It will be ON when warning occurs on the adapters. • Update period is 100ms.	R

*1 In the area of 16 words (256 bits), each node occupies 1 bit from node 1.

● Buffer memory (#1580 to #1663)

Buffer memory address	Name	Function	R/W
#1580 to 1595	Scan list register node table*1	ON: Node registered in the scan list is ON. • The node reserved for EtherNet/IP Device will not be ON.	R
#1596 to 1599	Reserved for system	Unavailable	-
#1600 to 1615	I/O msg RegistNode tbl*1	ON: It will be ON when more than 1 connection setting is registered for the node. • The node reserved for EtherNet/IP Device will not be ON.	R
#1616 to 1631	I/O msg Rrr node tbl*1	ON: The node on which cyclic (I/O) messages error occurs is ON. • After a communication error occurs, it is ON at the time when cyclic (I/O) messages error detection mask time expires.	R
#1632 to 1647	I/O msg Stop req node tbl*1	Object node of cyclic (I/O) messages stop request is ON. • All connections set for the node are stopped.	W
#1648 to 1663	I/O msg Restrt req node tbl*1	Object node of cyclic (I/O) messages restart request is ON. • All connections set for the node are restarted.	W

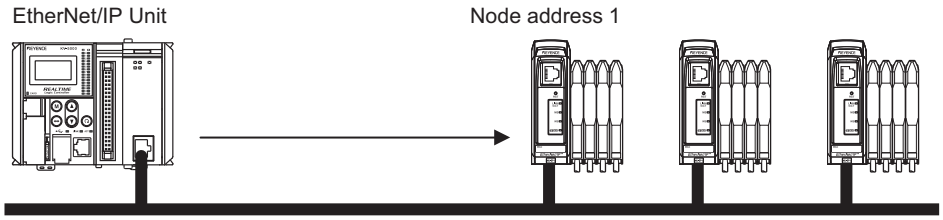
*1 • In the area of 16 words (256 bits), each node occupies 1 bit from node 1.
• If the unit-specific command is used, the program is available without using buffer memory address.
"Special command list for cyclic (I/O) messages", page 4-69

● Node table and assignment of node address

	Node address															
Device No.	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Leading No.+0	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Leading No.+1	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
Leading No.+2	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
Leading No.+3	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49
Leading No.+4	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65
Leading No.+5	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81
Leading No.+6	112	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97
Leading No.+7	128	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113
Leading No.+8	144	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129
Leading No.+9	160	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145
Leading No.+10	176	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161
Leading No.+11	192	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177
Leading No.+12	208	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193
Leading No.+13	224	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209
Leading No.+14	240	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225
Leading No.+15	256	255	254	253	252	251	250	249	248	247	246	245	244	243	242	241

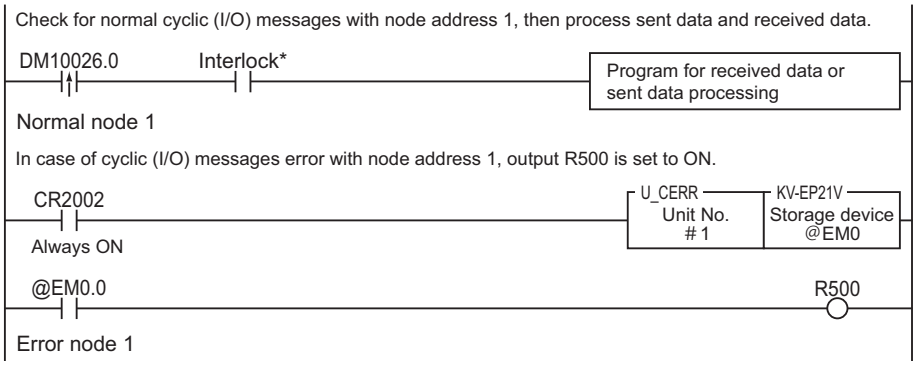
● Program when node table is used

The following describes the program used in cyclic (I/O) messages with the EtherNet/IP Device at node address 1.



Unit Editor Setting

Setting item	Description
Leading DM No.	DM10000
Leading relay No.	R30000



* If cyclic (I/O) messages data received from the object node contain information that represents normal data, it will be used as the interlock of the data processing.
(for example, sensor start ready Bit of EtherNet/IP communication unit NU-EP1)

■ Device for publicizing PLC status

The device is used to monitor the status of the CPU unit, base unit or KV-5500 connected to the KV-EP21V or KV-NC1EP.

Reference When the device for publicizing PLC status is assigned to the EtherNet/IP Unit tag setting, CPU unit status can be sent as cyclic (I/O) messages data.

● DM for publicizing PLC

N: Leading DM No.

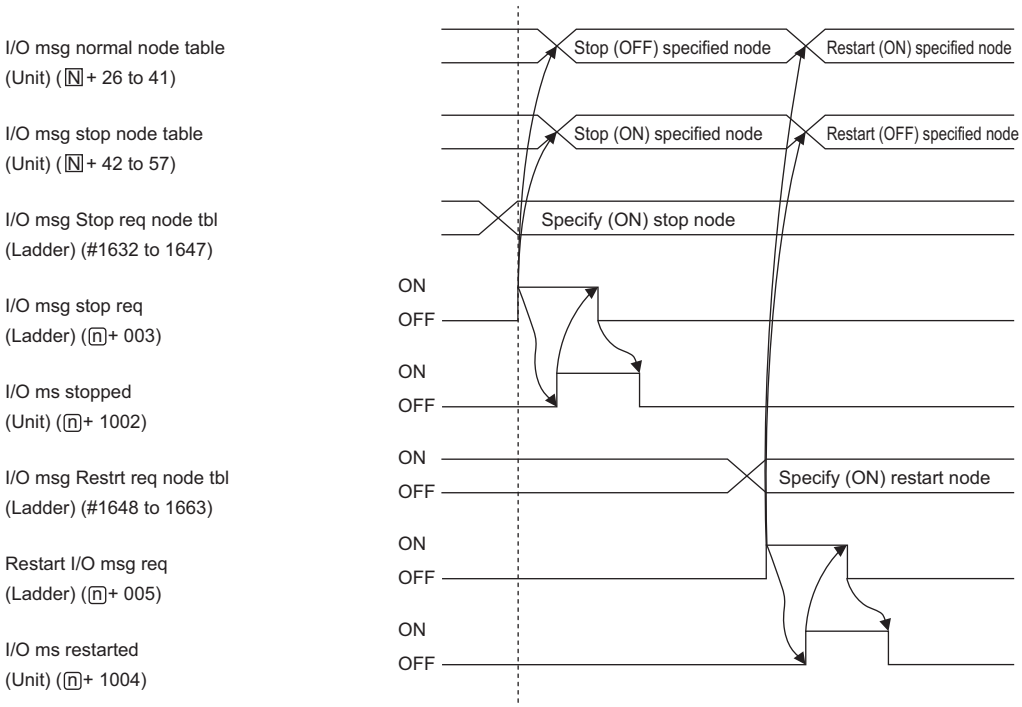
DM No.	Name	Function	R/W
N+90	PLC status	Bit 0: PLC operation mode (ON: RUN, OFF: PROG) Bit 1: PLC error status (ON: error) Bit 2 to 16: reserved for system	R
N+91	PLC error code	Store error No. of CPU unit is stored. If no error occurs, 0 is stored. • If both the severe error and minor error occur, the severe error is stored. If multiple severe errors occur, the earliest severe error is stored. • In case of expansion bus communication error (severe error), the value before error occurs is stored, and error No. is not stored.	R

Cyclic (I/O) Messages Stop Request and Restart Request

Steps and reference programs to stop and restart cyclic (I/O) messages using the Ladder program are described. Set the stop and restart nodes, and cyclic (I/O) messages stop request relay, and cyclic (I/O) messages restart request relay turn ON respectively. It is used for changing the communication object node according to operating conditions of the unit.

● Steps

The following describes the steps for the stop and restart of cyclic (I/O) messages by specifying node.



(Cyclic (I/O) messages stop steps)

(1) Specify the node to stop cyclic (I/O) messages in I/O msg stop req node tbl, and set the I/O msg stop req relay to ON.

(2) After I/O messages stops, the bit corresponding to I/O msg stop req node tbl will be ON, and cyclic (I/O) messages stop complete relay ON.

(3) After check I/O msg stop end relay ON, set the I/O msg stop req relay OFF.

(4) Check that the I/O msg stop node table has refreshed.

(Cyclic (I/O) messages restart steps)

(1) Specify the node to restart cyclic (I/O) messages in cyclic (I/O) messages restart request node table, and set the cyclic (I/O) messages restart request relay to ON.

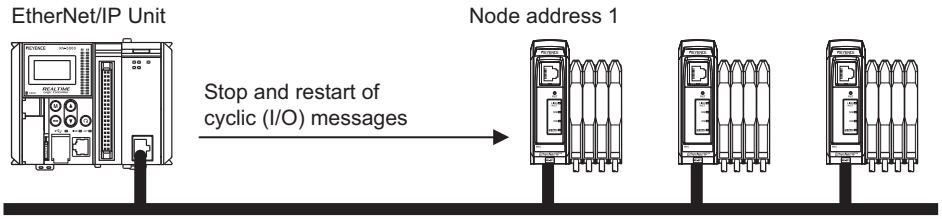
(2) After cyclic (I/O) messages restarts, the bit corresponding to cyclic (I/O) messages normal node table will be ON, the bit corresponding to cyclic (I/O) messages stop node table will be OFF, and cyclic (I/O) messages restart complete relay ON.

(3) After check cyclic (I/O) messages restart complete relay ON, set the cyclic (I/O) messages restart request relay OFF.

(4) Check that the I/O msg normal node table has refreshed.

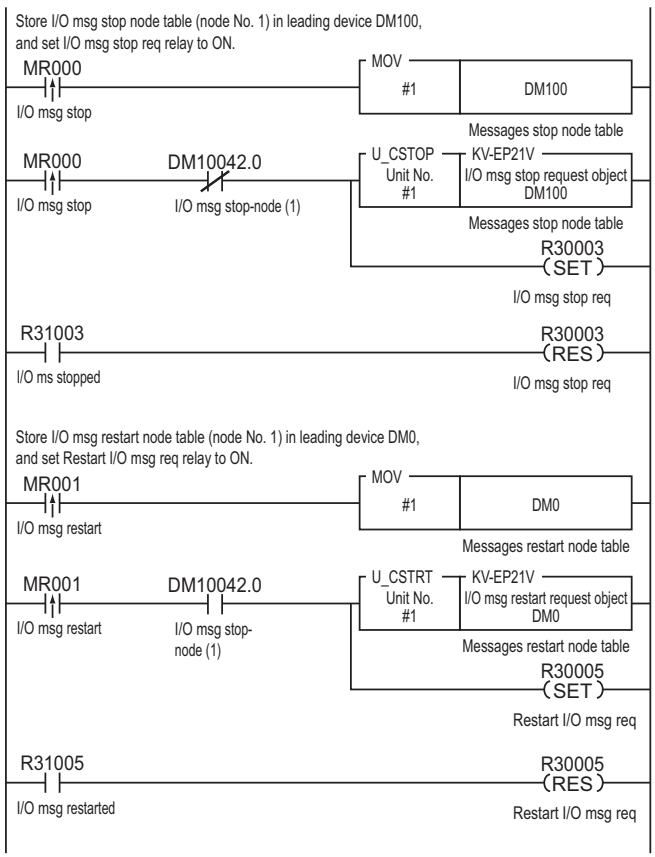
● Reference program

The sample program (for KV-EP21V) used for stopping and restarting communication with EtherNet/IP Devices of node address 1 is described below.



Unit Editor Setting

Setting item	Description
Leading DM No.	DM10000
Leading relay No.	R30000



<Mnemonic list>

```
LDP MR000
MOV #1 DM100
LDP MR000
AND DM10026.0
ANB DM10042.0
U_CSTOP #1 DM100
SET R30003
LD R31003
RES R30003
LDP MR001
MOV #1 DM0
LDP MR001
AND DM10042.0
U_CSTRT #1 DM0
SET R30005
LD R31005
RES R30005
```

Special Command for Cyclic (I/O) Messages

■ Special command list for cyclic (I/O) messages

Function	Command	Operation	Page
Cyclic (I/O) messages input refresh	RFSCI	Refresh cyclic (I/O) messages input data in the specified area.	4-70
Cyclic (I/O) messages output refresh	RFSCO	Refresh cyclic (I/O) messages output data in the specified area.	4-74

■ Unit-special command list for cyclic (I/O) messages

Function	Command	Operation	Page
Specify cyclic (I/O) messages stop request object node	U_CSTOP	Write cyclic (I/O) messages stop object node in the cyclic (I/O) messages stop request node table.	4-78
Specify cyclic (I/O) messages restart request object node	U_CSTRT	Write cyclic (I/O) messages restart object node in the cyclic (I/O) messages restart request node table.	4-80
Read cyclic (I/O) messages register node table	U_CREG	Read cyclic (I/O) messages register node table from the buffer memory.	4-82
Read cyclic (I/O) messages error in progress node table	U_CERR	Read cyclic (I/O) messages error in progress node table from the buffer memory.	4-84

RFSCI

RFSCI(.U)
RFSCI.S
RFSCI.D
RFSCI.L
RFSCI.F



Cyclic (I/O) messages input refresh

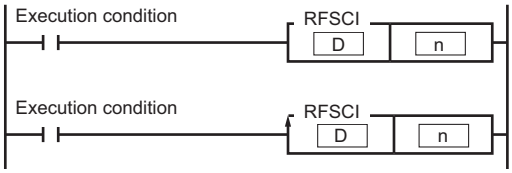
Refresh cyclic (I/O) messages input data.

@RFSCI

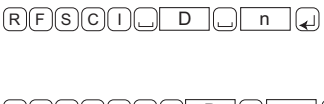
@RFSCI(.U)
@RFSCI.S
@RFSCI.D
@RFSCI.L
@RFSCI.F



Ladder program



Input method



Operand	Usable device															Constant	Indirect specifying		Local device	Index modification
	Bit device							Word device												
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
D	○	-	○	-	-	-	-	○	○*4	-	-	-	-	-	-	-	-	-	-	-
n	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-

Operand	Description
D	Specify the leading device No. to refresh cyclic (I/O) messages input data. *1*2*3
n	Specify the number of data to be refreshed.

*1 If bit device is specified, only R and B can be used.

*2 If bit device is specified, please specify the leading device of the channel.

*3 If word device is specified, only DM and W can be used.

*4 EM, FM and ZF cannot be used with the KV Nano Series.

Point

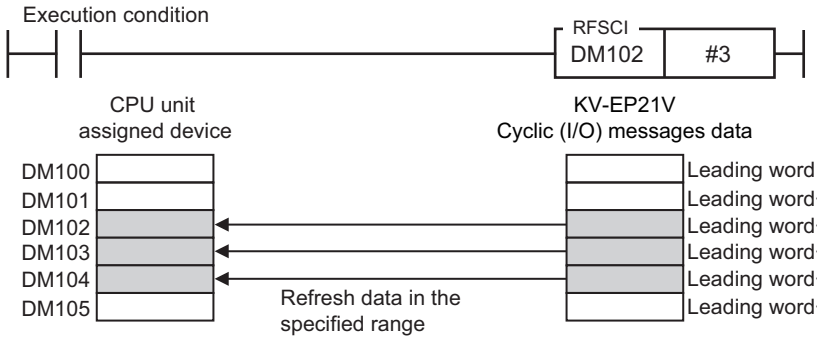
KV-EP21V, KV-5500 and KV-NC1EP can be used.

Operation Description

RFSCI(.U) If execution condition is ON, refresh the cyclic (I/O) messages input data from the data number specified to n from the 16 bit unsigned BIN data assigned to the device specified by D.

RFSCI.S If execution condition is ON, refresh the cyclic (I/O) messages input data from the data number specified to n from the 16 bit unsigned BIN data assigned to the device specified by D.

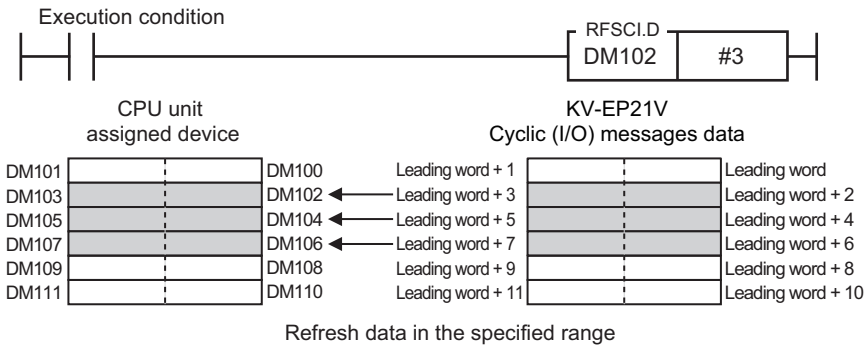
Example



RFSCI.D If execution condition is ON, refresh the cyclic (I/O) messages input data from the data number specified to [n] from the 32-bit unsigned BIN data assigned to the device specified by ([D]/[D]+1).

RFSCI.L If execution condition is ON, refresh the cyclic (I/O) messages input data from the data number specified to [n] from the 32-bit signed BIN data assigned to the device specified by ([D]/[D]+1).

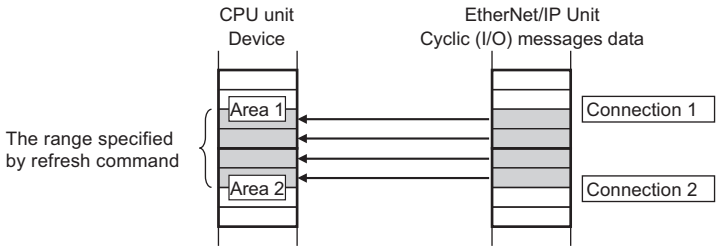
Example



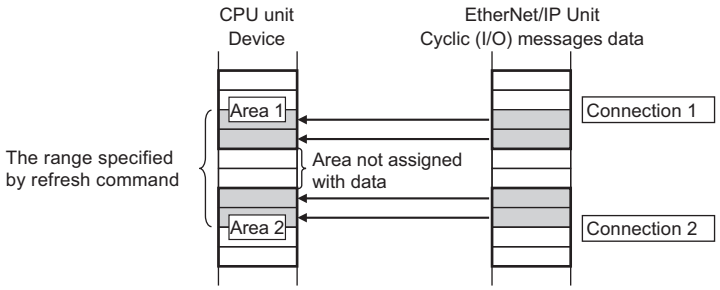
RFSCI.F If execution condition is ON, the cyclic (I/O) messages input data from the data number specified to [n] from the single floating real number assigned to the device specified by ([D]/[D]+1).

Point

- **Data synchronism for each connection cannot be guaranteed. However, synchronism of 2-word data can be guaranteed when leading offset in assignment area of the device specified by D is in even No., and the device specified by D is in even No..**
- **Only the device assigned to the connection is refreshed.**
- **Within the range specified by the operand, even if cyclic (I/O) message data of multiple EtherNet/IP Units or multiple connections exist, all specified cyclic (I/O) messages data will be refreshed.**



- **Within the range specified by the operand, if any device not assigned with cyclic (I/O) messages data exists, only devices assigned to the connection are refreshed.**



- **Please check communication status of the specified connection to be normal with the cyclic (I/O) messages normal node table, then execute refresh command.**

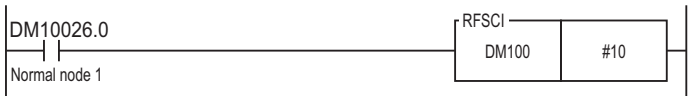
@RFSCI.□ Only one scan is executed at the rising edge of execution condition.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	No change

Sample Program

If cyclic (I/O) messages is normal, refresh 10-word cyclic (I/O) messages input data assigned to data memories after DM100.



<Mnemonic list>

```
LD DM10026.0
RFSCI DM100 #10
```

RFSCO

RFSCO(.U)
RFSCO.S
RFSCO.D
RFSCO.L
RFSCO.F

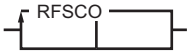


Cyclic (I/O) messages output refresh

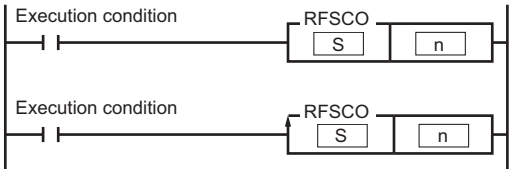
Refresh cyclic (I/O) messages output data.

@RFSCO

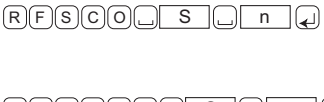
@RFSCO(.U)
@RFSCO.S
@RFSCO.D
@RFSCO.L
@RFSCO.F



Ladder program



Input method



Operand	Available device																		Index modification
	Bit device							Word device							Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
S	○	-	○	-	-	-	-	○	○*4	-	-	-	-	-	-	-	-	-	-	-
n	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-

Operand	Description
S	Specify the leading device No. to refresh cyclic (I/O) messages output data. *1*2*3
n	Specify the number of data to be refreshed.

*1 If bit device is specified, only R and B can be used.

*2 If bit device is specified, please specify the leading device of the channel.

*3 If word device is specified, only DM and W can be used.

*4 EM, FM and ZF cannot be used with the KV Nano Series.

Point

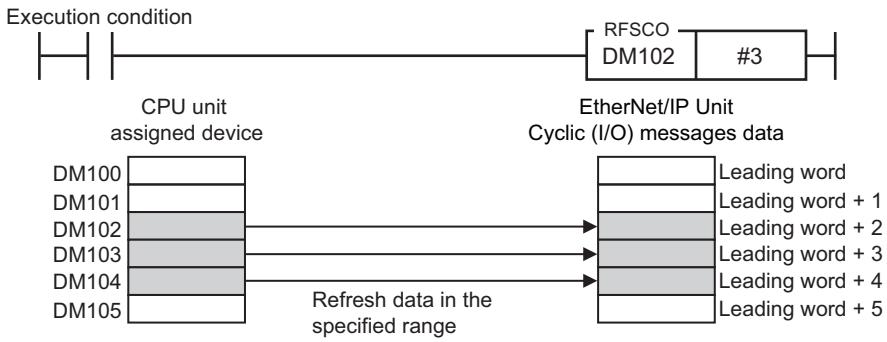
KV-EP21V, KV-5500 and KV-NC1EP can be used.

Operation Description

RFSCO(.U) If execution condition is ON, refresh the cyclic (I/O) messages input data from the data number specified to [n] from the 16-bit unsigned BIN data assigned to the device specified by [S].

RFSCO.S If execution condition is ON, refresh the cyclic (I/O) messages input data from the data number specified to [n] from the 16-bit signed BIN data assigned to the device specified by [S].

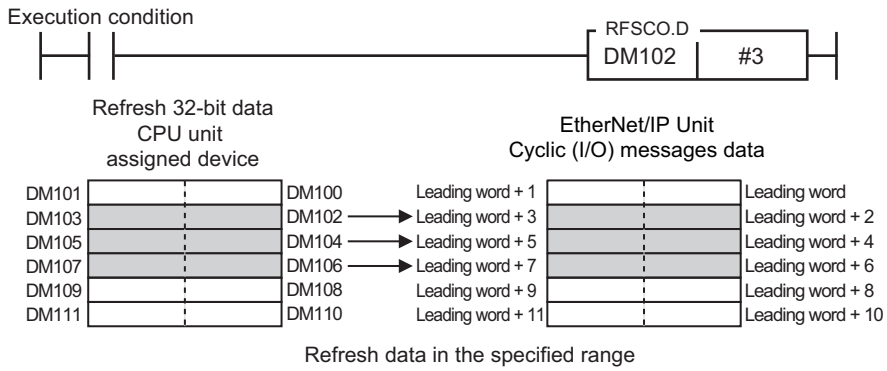
Example



RFSCO.D If execution condition is ON, refresh the cyclic (I/O) messages input data from the data number specified to [n] from the 32-bit unsigned BIN data assigned to the device specified by ([S]/[S]+1).

RFSCO.L If execution condition is ON, refresh the cyclic (I/O) messages input data from the data number specified to [n] from the 32-bit signed BIN data assigned to the device specified by ([S]/[S]+1).

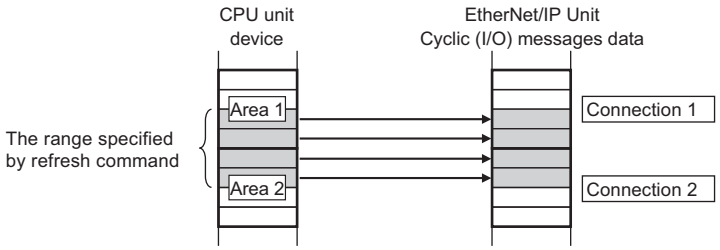
Example



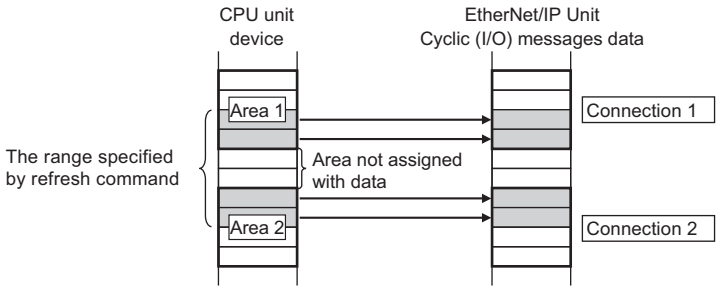
RFSCO.F If execution condition is ON, refresh the cyclic (I/O) messages input data from the data number specified to [n] from the single floating real number assigned to the device specified by ([S]/[S]+1).

Point

- **Data synchronism for each connection cannot be guaranteed. However, synchronism of 2-word data can be guaranteed when leading offset in assignment area of the device specified by S is in even No., and the device specified by S is in even No..**
- **Only the device assigned to the connection is refreshed.**
- **Within the range specified by the operand, even if cyclic (I/O) message data of multiple EtherNet/IP Units or multiple connections exist, all specified cyclic (I/O) messages data will be refreshed.**



- **Within the range specified by the operand, if any device not assigned with cyclic (I/O) messages data exists, only devices assigned to the connection are refreshed.**



- **Please check communication status of the specified connection to be normal with cyclic (I/O) messages normal node table, then execute refresh command.**

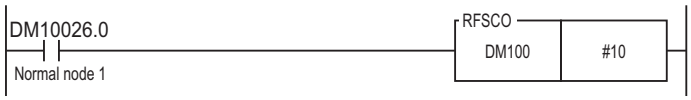
@RFSCO.☐ Only one scan is executed at the rising edge of execution condition.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	No change

Sample Program

If cyclic (I/O) messages are normal, refresh the 10-word cyclic (I/O) messages output data assigned to data memory after DM100.



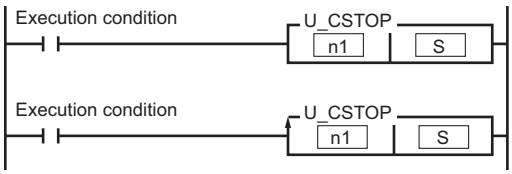
<Mnemonic list>

```
LD DM10026.0
RFSCO DM100 #10
```

U_CSTOP / @U_CSTOP

U_CSTOP	U_CSTOP(.U)	U_CSTOP	Specify cyclic (I/O) messages stop request object node
@U_CSTOP	@U_CSTOP(.U)	U_CSTOP	Write cyclic (I/O) messages stop request object node in the buffer memory.

Ladder program



Input method





Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
S	○	-	○	-	-	-	○	○	○*3	○	○	-	-	-	○	○	-	○	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
S	Specify the leading device to store cyclic (I/O) messages stop object node. *1*2

*1 If bit device is specified, consecutive 256 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 256 bits will be processed by crossing over to the next channel.

*2 If word device is specified, consecutive 16 words will be processed.

*3 EM, FM and ZF cannot be used with the KV Nano Series.

Operation Description

U_CSTOP If execution condition is ON, write 16-word cyclic (I/O) messages stop object node stored in devices in turn from S into the buffer memory of No. n1 unit.

	Device No.	Buffer memory address
Cyclic (I/O) messages stop request node table	S + 0 to S + 15	#1632 to #1647

"Node table and assignment of node address", page 4-65

If constant is specified for S, store the constant into 16-word buffer memories.
If FFFF (H) is input in S, all nodes can be specified.

@U_CSTOP Only one scan is executed at the rising edge of execution condition.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON when any of the following conditions is satisfied, otherwise, it is OFF. • The unit No. specified by n1 is out of range. • The unit with the unit No. specified with n1 is not KV-EP21V, KV-5500 or KV-NC1EP. • Consecutive 16-word devices from device No. specified by S cannot be ensured. • The range of indirect specifying and index modification is inappropriate.

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

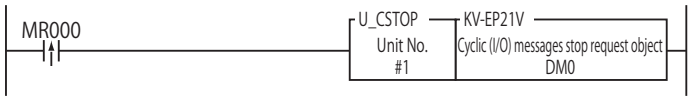
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

Sample Program

At the rising edge of MR000, specify cyclic (I/O) messages stop request object node as DM0 to DM15, and store it in the buffer memory.



<Mnemonic list>

```
LDP MR000
U_CSTOP #1 DM0
```

U_CSTRT / @U_CSTRT

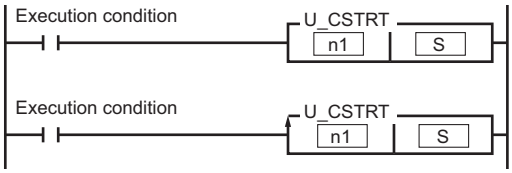
U_CSTRT(.U) 

@U_CSTRT(.U) 

Specify cyclic (I/O) messages restart request object node

Write cyclic (I/O) messages restart request object node in the buffer memory.

Ladder program



Input method





Operand	Available device																		Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
S	○	-	○	-	-	-	○	○	○*3	○	○	-	-	-	○	○	-	○	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
S	Specify the leading device to store cyclic (I/O) messages restart object node. *1*2

*1 If bit device is specified, consecutive 256 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 256 bits will be processed by crossing over to the next channel.

*2 If word device is specified, consecutive 16 words will be processed.

*3 EM, FM and ZF cannot be used with the KV Nano Series.

Operation Description

U_CSTRT If execution condition is ON, write 16-word cyclic (I/O) messages restart object node stored in devices starting from S into the buffer memory of No. n1 unit.

	Device No.	Buffer memory address
Cyclic (I/O) messages restart request node table	S + 0 to S + 15	#1648 to #1663

"Node table and assignment of node address", page 4-65

If constant is specified for S, store the constant into 16-word buffer memories. If FFFF (H) is input in S, all nodes can be specified.

@U_CSTRT Only one scan is executed at the rising edge of execution condition.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON when any of the following conditions is satisfied, otherwise, it is OFF. • The unit No. specified by n1 is out of range. • The unit with the unit No. specified with n1 is not KV-EP21V, KV-5500 or KV-NC1EP. • Consecutive 16-word devices from device No. specified by S cannot be ensured. • The range of indirect specifying and index modification is inappropriate.

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

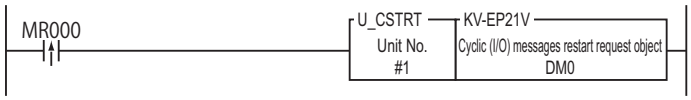
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

Sample Program

At the rising edge of MR000, specify cyclic (I/O) messages restart request object node as DM0 to DM15, and store it in the buffer memory.



<Mnemonic list>

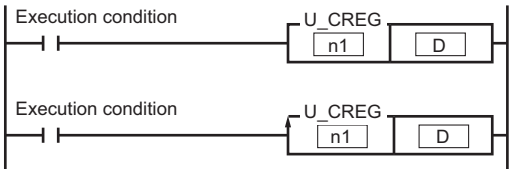
```
LDP MR000
U_CSTRT #1 DM0
```

U_CREG / @U_CREG

U_CREG	U_CREG(.U)		Read cyclic (I/O) messages register node table
@U_CREG	@U_CREG(.U)		

Read cyclic (I/O) messages register node table from the buffer memory.

Ladder program



Input method





Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
D	○	-	○	-	-	-	○	○	○*3	○	○	-	-	-	○	-	-	○	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
D	Specify the leading device to store cyclic (I/O) messages register node table. *1*2

*1 If bit device is specified, consecutive 256 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 256 bits will be processed by crossing over to the next channel.

*2 If word device is specified, consecutive 16 words will be processed.

*3 EM, FM and ZF cannot be used with the KV Nano Series.

Operation Description

U_CREG If execution condition is ON, read cyclic (I/O) messages register node table of No. n1 unit, and store it in 16-word devices with D as leading device.

	Buffer memory address		Device No.
Cyclic (I/O) messages register node table	#1600 to #1615	→	D + 0 to D + 15

"Node table and assignment of node address", page 4-65

@U_CREG Only one scan is executed at the rising edge of execution condition.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON when any of the following conditions is satisfied, otherwise, it is OFF. • The unit No. specified by n1 is out of range. • The unit with the unit No. specified with n1 is not KV-EP21V, KV-5500 or KV-NC1EP. • When it cannot ensure to read device of 16 words from D the specified device • The range of indirect specifying and index modification is inappropriate.

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

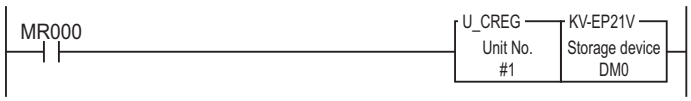
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

Sample program

When MR000 is ON, read cyclic (I/O) messages register node table, and store it in DM0 to DM15.



<Mnemonic list>

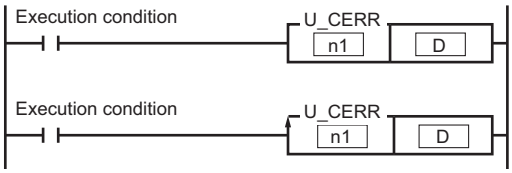
```
LD MR000
U_CREG #1 DM0
```

U_CERR / @U_CERR

U_CERR	U_CERR(.U)		Read cyclic (I/O) messages error in progress node table
@U_CERR	@U_CERR(.U)		

Read cyclic (I/O) messages error in progress node table from the buffer memory.

Ladder program



Input method





Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
D	○	-	○	-	-	-	○	○	○*3	○	○	-	-	-	○	-	-	○	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
D	Specify the leading device to store cyclic (I/O) messages register node table. *1*2

*1 If bit device is specified, consecutive 256 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 256 bits will be processed by crossing over to the next channel.

*2 If word device is specified, consecutive 16 words will be processed.

*3 EM, FM and ZF cannot be used with the KV Nano Series.

Operation Description

U_CERR If execution condition is ON, read cyclic (I/O) messages error in progress node table of No. n1 unit, and store it in 16-word devices with D as leading devices.

	Buffer memory address		Device No.
Cyclic (I/O) messages error in progress node table	#1616 to #1631	→	D + 0 to D + 15

"Node table and assignment of node address", page 4-65

@U_CERR Only one scan is executed at the rising edge of execution condition.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON when any of the following conditions is satisfied, otherwise, it is OFF. • The unit No. specified by n1 is out of range. • The unit with the unit No. specified with n1 is not KV-EP21V, KV-5500 or KV-NC1EP. • 16-word devices from device No. specified by D cannot be ensured • The range of indirect specifying and index modification is inappropriate.

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

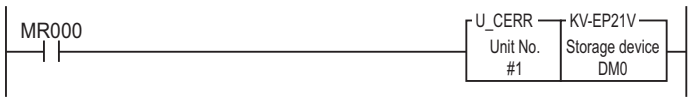
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

Sample Program

When MR000 is ON, read cyclic (I/O) messages error in progress node table, and store it in DM0 to DM15.



<Mnemonic list>

```
LD MR000
U_CERR #1 DM0
```

Specific Function for Cyclic (I/O) Messages

■ Specific function list for cyclic (I/O) messages

Function	Function	Operation	Page
Cyclic (I/O) messages input refresh	RFSCI	Refresh cyclic (I/O) messages input data in the specified area.	4-88
Cyclic (I/O) messages output refresh	RFSCO	Refresh cyclic (I/O) messages output data in the specified area.	4-90

■ Unit-specific function list for cyclic (I/O) messages

Function	Function	Operation	Page
Specify cyclic (I/O) messages stop request object node	U_CSTOP	Write cyclic (I/O) messages stop object node in the cyclic (I/O) messages stop request node table.	4-92
Specify cyclic (I/O) messages restart request object node	U_CSTRT	Write cyclic (I/O) messages restart object node in the cyclic (I/O) messages restart request node table.	4-93
Read cyclic (I/O) messages register node table	U_CREG	Read cyclic (I/O) messages register node table from the buffer memory.	4-94
Read cyclic (I/O) messages error in progress node table	U_CERR	Read cyclic (I/O) messages error in progress node table from the buffer memory.	4-95

MEMO

RFSCI Cyclic (I/O) messages input refresh

RFSCI ([execution condition]*1, leading device No., number of data)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
D	Leading device *2	Specify the leading device No. to refresh cyclic (I/O) messages input data.	.U	.S	.D	.L	.F	-	-		-	○	-
n	Number of data	Specify the number of data to be refreshed.	.U	.U	.U	.U	-	-	-		○	-	-
R	Return value	None	-	-	-	-	-	-	-		-	-	-

*1 [ ] can be omitted. (If execution condition is omitted, function is executed in each scanning)

*2 If bit device is specified, please specify the leading device of the channel.

Point

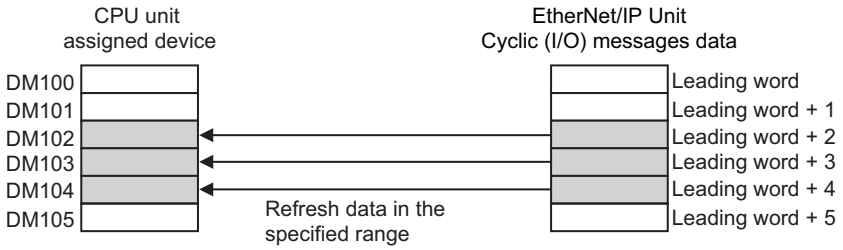
KV-EP21V, KV-5500 and KV-NC1EP can be used.

Operation Description

If execution condition is ON, refresh the cyclic (I/O) messages input data from the data number specified to n from the data assigned to the devices specified by D. (If the leading device is 32-bit data, the number of refreshed words is number of data x 2.)

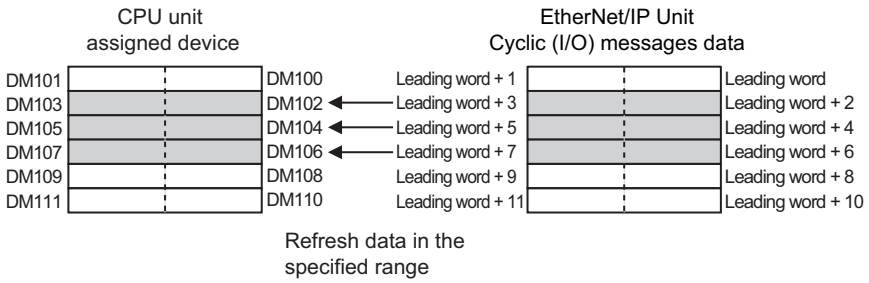
- D: leading device is 16-bit data (.U/.S)

  Example) specify leading device as DM102 (.U), number of data as 3



- D: leading device is 32-bit data (.D/.L/.F)

  Example) specify leading device as DM102.D, number of data as 3



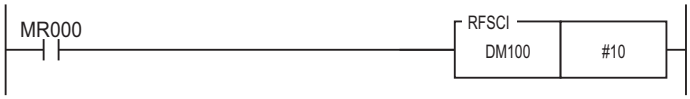
For details, see "RFSCI command (cyclic (I/O) messages input refresh)" (page 4-70).

● Format example

Script programming RFSCI(MR0,DM100.U,10)

Operation description When MR000 is ON, refresh 10-word cyclic (I/O) messages input data assigned to data memories after DM100.

Ladder conversion



RFSCO Cyclic (I/O) messages output refresh

RFSCO ([execution condition]*1, leading device No., number of data)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
S	Leading device *2	Specify the leading device No. to refresh cyclic (I/O) messages output data.	.U	.S	.D	.L	.F	-	-		-	○	-
n	Number of data	Specify the number of data to be refreshed.	.U	.U	.U	.U	-	-	-		○	-	-
R	Return value	None	-	-	-	-	-	-	-		-	-	-

*1 [ ] can be omitted. (If execution condition is omitted, function is executed in each scanning)

*2 If bit device is specified, please specify the leading device of the channel.

Point

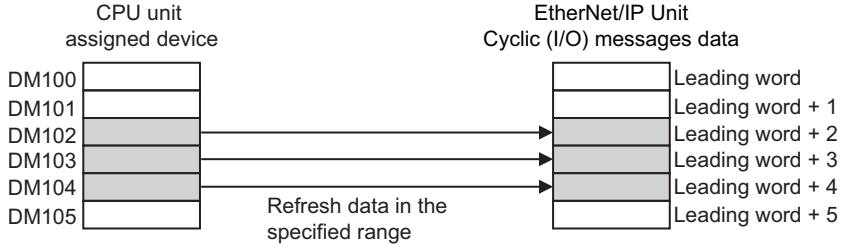
KV-EP21V, KV-5500 and KV-NC1EP can be used.

Operation Description

If execution condition is ON, the cyclic (I/O) messages input data from the data number specified to n from the data assigned to the devices specified by S. (If the leading device is 32-bit data, the number of refreshed words is number of data x 2.)

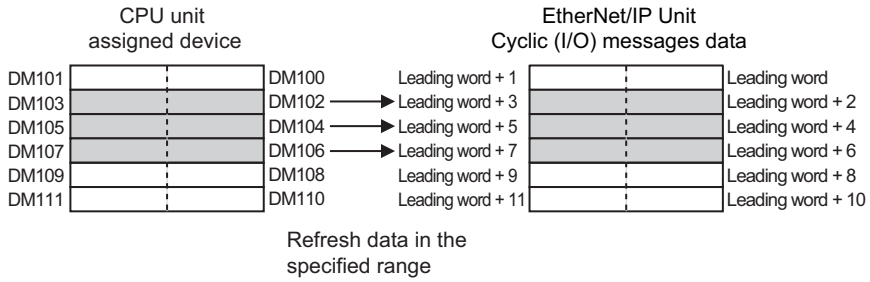
- S: leading device is 16-bit data (.U/.S)

  Example) specify leading device as DM102 (.U), number of data as 3



- S: leading device is 32-bit data (.D/.L/.F)

  Example) specify leading device as DM102.D, number of data as 3



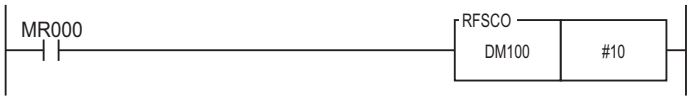
For details, see "RFSCO command (cyclic (I/O) messages output refresh)" (page 4-74).

● Format example

Script programming RFSCO(MR0,DM100.U,10)

Operation description When MR000 is ON, refresh 10-word cyclic (I/O) messages input data assigned to data memories after DM100.

Ladder conversion



U_CSTOP Specify cyclic (I/O) messages stop request object node

U_CSTOP ([Execution condition]*1, unit No., cyclic (I/O) messages stop request object)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No.*2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	-
S	Leading device No.*3*4*5	Specify the leading device No. to store cyclic (I/O) messages stop object node.	.U	.U	.U	.U	-	-	-	-	-	○	-

*1 [ ] can be omitted. (If execution condition is omitted, function is executed with each scan.)
*2 $ (specify hex) cannot be used.
*3 CTC, CTH, and Z cannot be specified.
*4 If bit device is specified for S, consecutive 256 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 256 bits will be processed by crossing over to the next channel.
*5 If the word device is specified for S, consecutive 16 words will be processed.

Operation Description

U_CSTOP If execution condition is ON, write 16-word explicit messages stop request object node stored in devices starting from S in the buffer memory of No. n unit.

	Device No.		Buffer memory address
Cyclic (I/O) messages stop request node table	S +0 to S +15	→	#1632 to #1647

"Node table and assignment of node address", page 4-65

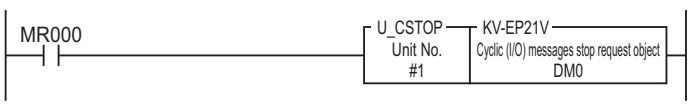
If constant is specified for S, store the constant into 16-word buffer memories. If FFFF (H) is input in S, all nodes can be specified.

● Format example

Script programming U_CSTOP(MR0,1,DM0)

Operation description When MR000 is ON, specify cyclic (I/O) messages stop request object node as DM0 to DM15, and store it in the buffer memory.

Ladder conversion



U_CSTRT Specify cyclic (I/O) messages restart request object node

U_CSTRT ([execution condition]*1, unit No., cyclic (I/O) messages restart request object)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No.*2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	-
S	Restart request object *3*4*5	Specify the leading device No. to stored cyclic (I/O) messages restart request table.	.U	.U	.U	.U	-	-	-	-	-	○	-

*1 [ ] can be omitted. (If execution condition is omitted, function is executed with each scan.)
*2 $ (specify hex) cannot be used.
*3 CTC, CTH, and Z cannot be specified.
*4 If bit device is specified for S, consecutive 256 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 256 bits will be processed by crossing over to the next channel.
*5 If word device is specified for S, consecutive 16 words will be processed.

Operation Description

U_CSTRT If execution condition is ON, write 16-word explicit messages restart request object node stored in devices starting from S in the buffer memory of No. n unit.

	Device No.		Buffer memory address
Cyclic (I/O) messages restart request node table	S +0 to S +15	⇨	#1648 to #1663

"Node table and assignment of node address", page 4-65

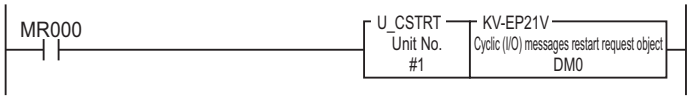
If constant is specified for S, store the constant into 16-word buffer memories. If FFFF (H) is input in S, all nodes can be specified.

- **Format example**

Script programming U_CSTRT(MR0,1,DM0)

Operation description When MR000 is ON, specify the cyclic (I/O) messages restart request object node as DM0 to DM15, and store it in the buffer memory.

Ladder conversion



U_CREG Read cyclic (I/O) messages register node table

U_CREG ([execution condition]*1, unit No., storage target device No.)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No. *2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	-
D	Storage target device No.*3*4*5	Specify the leading device No. to store cyclic (I/O) messages register node table.	.U	.U	.U	.U	-	-	-	-	-	○	-

*1 [ ] can be omitted. (If execution condition is omitted, function is executed in each scanning.)
*2 $ (specify hex) cannot be used.
*3 CTC, CTH, and Z cannot be specified.
*4 If bit device is specified for D, consecutive 256 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 256 bits will be processed by crossing over to the next channel.
*5 If word device is specified for D, consecutive 16 words will be processed.

Operation Description

U_CREG If execution condition is ON, read cyclic (I/O) messages register node table of No. n unit, and store it in 16-word devices with D as leading device.

	Buffer memory address	Device No.
Cyclic (I/O) messages register node table	#1600 to #1615	D + 0 to D + 15

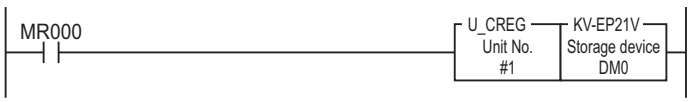
"Node table and assignment of node address", page 4-65

- **Format example**

Script programming U_CREG(MR0,1,DM0)

Operation description When MR000 is ON, read the cyclic (I/O) messages register node table of the first unit connected , and store it in DM0 to DM15.

Ladder conversion



U_CERR Read cyclic (I/O) messages error in progress node table

U_CERR ([execution condition]*1, unit No., storage device No.)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No.*2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	-
D	Storage device No.*3*4*5	Specify the leading device No. to store cyclic (I/O) messages error in progress node table.	.U	.U	.U	.U	-	-	-	-	-	○	-

*1 [ ] can be omitted. (If execution condition is omitted, function is executed in each scanning.)
*2 $ (specify hex) cannot be used.
*3 CTC, CTH, and Z cannot be specified.
*4 If bit device is specified for D, consecutive 256 bit will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 256 bits will be processed by crossing over to the next channel.
*5 If word device is specified for D, consecutive 16 words will be processed.

Operation Description

U_CERR If execution condition is ON, read cyclic (I/O) messages error in progress node table of No. n unit, and store it in 16-word devices with D as leading device.

	Buffer memory address		Device No.
Cyclic (I/O) messages error in progress node table	#1616 to #1631	→	D + 0 to D + 15

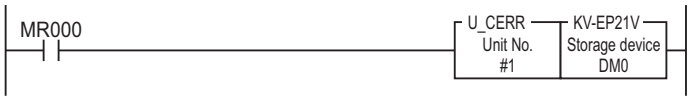
"Node table and assignment of node address", page 4-65

● Format example

Script programming U_CERR(MR0,1,DM0)

Operation description When MR000 is ON, read the cyclic (I/O) messages error in progress node table of the first unit connected, and store it in DM0 to DM15.

Ladder conversion

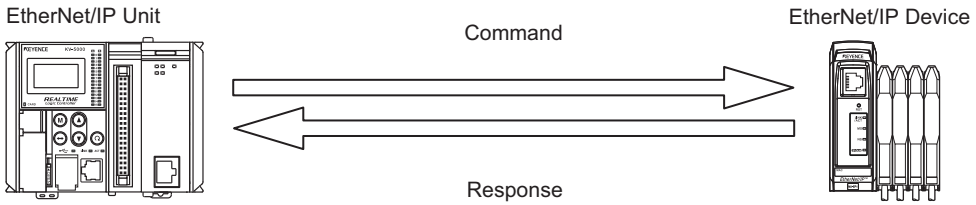


4-4 Explicit Messages (Client) Function

The section describes explicit messages (client) function and how to use it.

Overview

Explicit messages (client) function is one type of CIP communication, which is used in general explicit messages between client - server (peer-to-peer).
EtherNet/IP Units support Explicit messages UCMM (non-connection type) specified by CIP, messages can be sent by setting a communication object and send data in the buffer memory, and turning the explicit messages execution request relay to ON.
With explicit messages (client) function, services of each EtherNet/IP Device can be used to read/write data or parameters not assigned to cyclic (I/O) messages, services (such as reset) can also be executed.



Reference

- Objects and Services (ServiceCode) are prepared for EtherNet/IP Device. Object represents function and data of units in the abstract way, Class ID, Instance ID, and Attribute ID are used to specify the object. For example, to read data, service (Get_Attribute_Single: 0EH) for reading data can be used, Class ID, instance ID, and attribute ID can be used to do such things as speciy data. Services that do not need instance ID or attribute ID also exist.
  There are two types of object and service, i.e. object and service, specified by standard and intrinsic object and service of the unit. For EtherNet/IP Unit service and objects, see "4-5 Explicit Messages (Server) Function", page 4-119.
- Explicit messages can be executed for the EtherNet/IP Device connected with PC from "Explicit messages" dialog box in EtherNet/IP Setting.
  "Explicit Messages", page 5-54
- If node status acquisition function is used, operation status of the nodes can be checked only by specifying node address.
  "4-6 Node Status Acquisition Function", page 4-155

Point

- **The explicit messages (client) function of EtherNet/IP Units does not support Class 3 (connection type) mode.**
- **When the explicit messages (client) function is used, explicit messages can be executed by specifying the IP address of the EtherNet/IP Device from the EtherNet/IP Unit to send information. It is not necessary for the EtherNet/IP Device to be registered in the scan list.**

Data Format of Explicit Messages (Client) Function

The following describes the data format overview of explicit messages (client) function.
For the command and response details, see appropriate EtherNet/IP Device manual.

■ Command format

(1) ServiceCode	(2) Class ID	(3) Instance ID	(4) Attribute ID	(5) ServiceData

Item	Description
(1) ServiceCode	Specify ServiceCode to be used.
(2) Class ID	Specify Class ID according to the service used.*1
(3) Instance ID	Specify Instance ID according to the service used.*1
(4) Attribute ID	Specify Attribute ID according to the service used.*1
(5) ServiceData	Specify ServiceData according to the service used.*2

*1 Logic segment of Class ID, Instance ID, and Attribute ID will be attached automatically when messages are sent . For logic segment, see "Communication format", page 4-122.

*2 ServiceData are specified in byte array of Little Endian format.
For data type and device storage format in EtherNet/IP communication, see "Data Type and Device Storage Mode", page 4-172.

Reference When executing explicit messages (client) function, IP address of EtherNet/IP Device is specified to send the above-mentioned command.

■ Response format

(1) General Status	(2) Addition Status	(3) Reception Service Data

Item	Description
(1) General Status	General Status corresponding to the command is stored in the buffer memory. 00H is returned in normal status. *1
(2) Addition Status	Additional Status is stored in the buffer memory. *1
(3) Reception Service Data	Reception Service Data corresponding to the command is stored in the buffer memory. *2

*1 For error details specified by CIP, see "CIP General Status List", page 4-153.

*2 Reception Service Data are stored in byte array of Little Endian format.
For data type and device storage format in EtherNet/IP communication, see "Data Type and Device Storage Mode", page 4-172.

Unit Editor Setting Related with Explicit Messages (Client) Function

Unit Editor Setting of KV STUDIO related with explicit messages (client) function.
For other setting items in ”Basic” of the Unit Editor, please set to appropriate value as required.
"Setting Item List", page 3-4

Unit Editor Setting

Item	Setting range	Default value	See page
"Basic"			
Leading DM No.	0 to 65304 (0 to 32538 for KV-NC1EP)	To be set	3-6
Leading relay No. (ch unit setting)	10 to 960 (10 to 560 for KV-NC1EP)	To be set	3-6
Baud rate	"100/10Mbps automatic"/"10Mbps"	100/10Mbps automatic	3-6
Setting method of IP address	Fixed IP address/BOOTP/ Fixed IP Auto switching/BOOTP	Fixed IP address	3-6
IP address	(0 to 255).(0 to 255).(0 to 255).(0 to 255)	192.168.0.10	3-7
Subnet mask	(0 to 255).(0 to 255).(0 to 255).(0 to 255)	255.255.255.0	3-7
EtherNet/IP Setting			
Explicit messages time out (ms)	10 to 65530	10000	3-12

Device used for Explicit Messages Communication

■ Relay

n: Leading relay No.

Relay No.	Name	Function	R/W
n+700	Explicit msg execute req	OFF->ON: execute explicit messages. Next explicit messages execution request will not be accepted if explicit messages execution is in progress.	W
n+1700	Explicit msg end	ON: it will be ON after explicit messages is executed. ON->OFF: it will be OFF when explicit messages execution request relay is OFF.	R
n+1701	Explicit msg fail	ON: Both it and complete relay will be ON if error occurs during explicit messages execution. ON->OFF: it will be OFF when explicit messages execution request relay is OFF.	R

■ Buffer memory

Buffer memory address	Name	Function	R/W
#1800	Explicit recvr IP addr [1/4] *1	Store IP address of send destination. [1/4]:[2/4]:[3/4]:[4/4] The setting range is 0 to 255.	W
#1801	Explicit recvr IP addr [2/4] *1		W
#1802	Explicit recvr IP addr [3/4] *1		W
#1803	Explicit recvr IP addr [4/4] *1		W
#1804	Explicit msg ServiceCode*1	Store ServiceCode. The setting range is 0000 to 007FH.	W
#1805	Explicit msg Class ID *1	Store Class ID. The setting range is 0000 to FFFEH.	W
#1806	Explicit msg Instance ID *1	Store Instance ID. The setting range is 0000 to FFFEH. • Omitted when FFFFH is stored.	W
#1807	Explicit msg Attribute ID *1	Store Attribute ID. The setting range is 0000 to FFFEH. • Omitted when FFFFH is stored.	W
#1808	Reserved for system	Unavailable	-
#1809	Reserved for system	Unavailable	-
#1810	Explicit msg end code*1	Store complete code.	R
#1811	Explicit details end code*1	Store detailed complete code.	R
#1812 to 1899	Reserved for system	Unavailable	-

Buffer memory address	Name	Function	R/W
#1900	Explicit send service data size*1	Store send data size in byte. If instance ID, and attribute ID are omitted, max. value is 500 (bytes). If attribute ID is omitted, max. value is 498 (bytes). If not omitted, max. value is 496 (bytes).	W
#1901	Explicit send service data head*1	Store the sent data in byte array of Little Endian format. "Data Type and Device Storage Mode", page 4-172	W
:	:		W
#2152	Explicit send service data tail		W
#2153 to 2199	Reserved for system	Unavailable	-
#2200	Explicit recv service data size 0*1	Store received data size in byte.	R
#2201	Explicit recv Service data head*1	Store the received data in byte array of Little Endian format.	R
:	:		R
#2452	Explicit recv Service data tail		R

*1 If unit-specific command is used, the program is available without using the buffer memory address. "Unit-specific Command for Explicit Messages", page 4-105

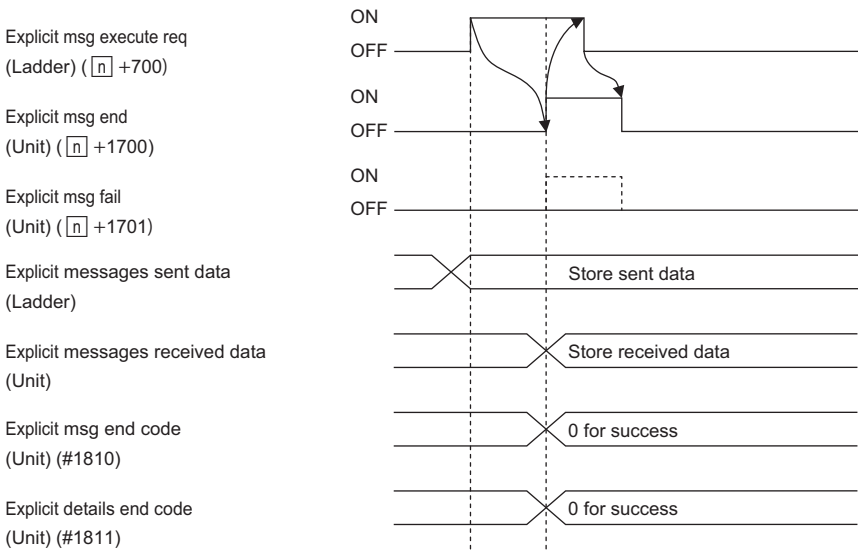
● Explicit messages complete code/explicit messages detailed complete code

Reference When problems can not be solved based on causes and measures, or check method is unclear, see the troubleshooting No. description. "Troubleshooting", page A-16

Complete code (Decimal)	Detailed complete code (Decimal)	Description	Causes and measures	Troubleshooting No.
0	0	OK	-	-
1 to 255	0 to 65535	CIP error	Return General Status specified by CIP from EtherNet/IP Device of the communication object. "CIP General Status List", page 4-153	100
10500	0	Explicit messages time out error	Explicit messages time out occurs. • Please check power supply, and cable status of the units on communication line, such as target unit or Ethernet switch etc. • Please check Ethernet link status to be 100Mbps, full duplex via Unit Monitor. • Please check whether unexpected network load exists.	102
10501	0	Processing interrupt error	Since either Ladder program transfer or Reset service is executed, the processing is interrupted.	103

Complete code (Decimal)	Detailed complete code (Decimal)	Description	Causes and measures	Troubleshooting No.
10502	0	Processing interrupt error	Since either Ladder program transfer or Reset service is executed, the processing is interrupted.	103
10507	0	Unset IP address error	Since IP address is not set, the function cannot be executed. • Please set IP address.	129
10900	0	Specified IP address exception error	The specified IP address is incorrect.	126
10901	0	Incorrect ServiceCode error	Incorrect ServiceCode. 128 to 255 cannot be specified.	126
10902	0	Specified data size error	The send service data size is too large.	126
10903	0	Incorrect Class ID error	Incorrect Class ID. 65535 cannot be specified.	126

Explicit Messages Steps



(1) Store messages send destination IP address*, explicit msg ServiceCode*, explicit msg Class ID*, explicit msg Instance ID*, explicit msg Attribute ID*, explicit send service data size*, and explicit send service data* in the buffer memory.

(2) Turn explicit msg execute req relay to ON.

(3) After explicit messages is completed, store explicit recv Service Data size*, explicit recv Service Data*, explicit msg end code (store 0 in case of success)*, and explicit details end code * in the buffer memory, and turn explicit msg end relay ON.
If explicit messages fail relay is ON, read explicit msg end code, and execute error processing.

(4) Please check explicit msg end relay is ON, and set explicit msg execute req relay to OFF.

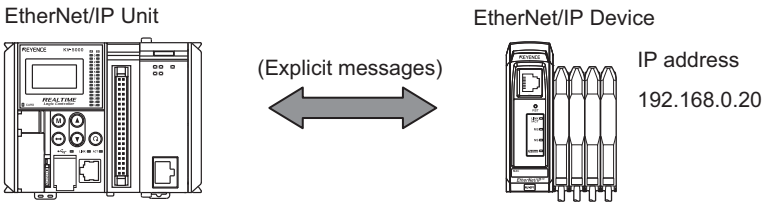
(5) If the EtherNet/IP Unit detects explicit msg execute req relay OFF, the explicit msg end relay will change to OFF.

* If unit-specific command is used, program is available without using buffer memory address.
"Unit-specific Command for Explicit Messages", page 4-105

Reference If the command related with CIP messages is used in explicit messages, creation of sent data in CIP data type, and acquisition from the received data can be executed easily.
"Command Related with CIP Data", page 4-174

Sample Program of Explicit Messages (Client) Function

The following describes the sample program to execute explicit messages between EtherNet/IP Units and EtherNet/IP Devices.
This is an example of KV-EP21V.



Unit Editor Setting

Setting item	Description
Leading DM No.	DM10000
Leading relay No.	R30000

Storage area of the data used in the sample program

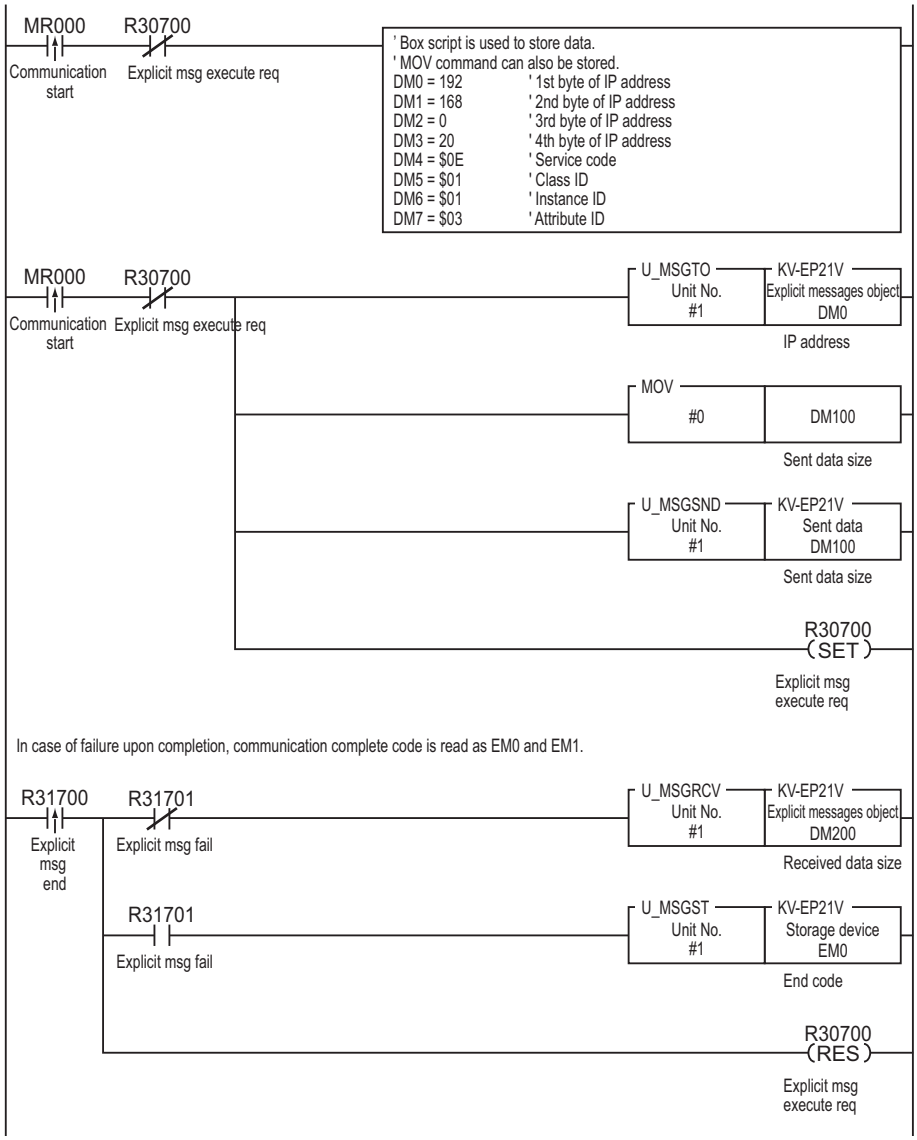
DM0 to 3	IP address setting
DM4 to 7	Send service setting
DM100	Send data size
DM101 to	Send data
DM200	Receive data size
DM201 to	Receive data
EM0	Complete code
EM1	Detailed complete code

Example, execute Get_Attribute_Single service to EtherNet/IP Device (IP address: 192.168.0.20), and read product code of Identity object.

Setting item	Data	Description
ServiceCode	0EH	Specify Get_Attribute_Single (0EH).
Class ID	01H	Specify Identify object (01H).
Instance ID	01H	Specify object instance ID.
Attribute ID	03H	Specify object attribute ID (product code).
ServiceData	(not required)	Service that does not need service data also exists.

For the object and service applicable to EtherNet/IP Units, see

"4-5 Explicit Messages (Server) Function", page 4-119.



Point

Even if service data is not required, it is necessary to write 0 in the explicit messages send service data size.

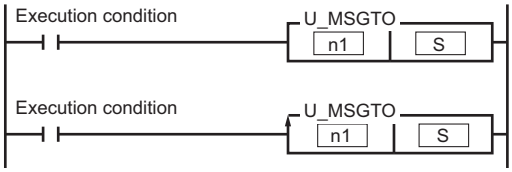
Unit-specific Command for Explicit Messages

■ Unit-specific command list for explicit messages

Function	Command	Operation	Page
Specify explicit messages object	U_MSGTO	Write explicit messages object setting in the buffer memory.	4-106
Write explicit messages send data	U_MSGSND	Write explicit messages send data in the buffer memory.	4-108
Read explicit messages receive data	U_MSGRCV	Read explicit messages receive data from the buffer memory.	4-110
Read explicit messages complete code	U_MSGST	Read explicit messages complete code and detailed code from the buffer memory.	4-112

U_MSGTO	**U_MSGTO(.U)**	U_MSGTO	Specify explicit messages object	Write explicit messages object setting in the buffer memory.
@U_MSGTO	**@U_MSGTO(.U)**	U_MSGTO		

Ladder program



Input method

U␣MSGTO␣n1␣S↵

@U␣MSGTO␣n1␣S↵

Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
S	○	-	○	-	-	-	○	○	○*3	○	○	-	-	-	○	○	-	-	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
S	Specify the leading device to store explicit messages object setting. *1*2

*1 If bit device is specified, consecutive 128 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 128 bits will be processed by crossing over to the next channel.

*2 If word device is specified, consecutive 8 words will be processed.

*3 EM, FM and ZF cannot be used with the KV Nano Series.

Operation Description

U_MSGTO If execution condition is ON, write 8-word explicit messages object setting stored in devices in turn from S in the buffer memory of No. n1 unit.

Device No.			Buffer memory address
1st byte of IP address	S	+0	#1800
2nd byte of IP address	S	+1	#1801
3rd byte of IP address	S	+2	#1802
4th byte of IP address	S	+3	#1803
ServiceCode	S	+4	#1804
Class ID	S	+5	#1805
Instance ID	S	+6	#1806
Attribute ID	S	+7	#1807

@U_MSGTO Only one scan is executed at the rising edge of execution condition.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON if any of the following conditions is met, otherwise it is OFF. • The unit No. specified by n1 is out of range. • The unit with the unit No. specified with n1 is not KV-EP21V, KV-5500 or KV-NC1EP. • Consecutive 8-word devices from the device specified by S cannot be ensured. • The range of indirect specifying and index modification are inappropriate.

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

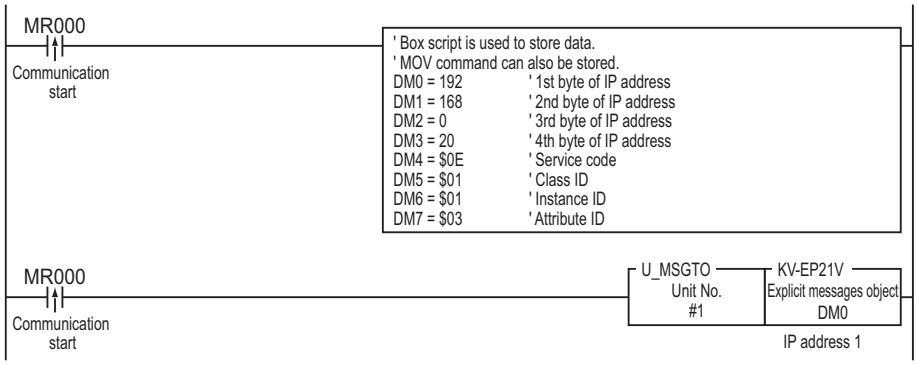
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

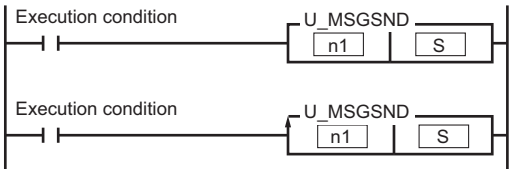
Sample Program

At the rising edge of MR0, specify explicit messages object setting as DM0 to DM7, and write it in the buffer memory.



U_MSGSND	**U_MSGSND(.U)**	U_MSGSND	Write explicit messages send data	Write explicit messages send data in the buffer memory.
@U_MSGSND	**@U_MSGSND(.U)**	U_MSGSND		

Ladder program



Input method

U _ M S G S N D _ n1 _ S ↵

@ U _ M S G S N D _ n1 _ S ↵

Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
S	○	-	○	-	-	-	○	○	○*3	○	○	-	-	-	○	○	-	-	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
S	Specify the leading device to store explicit messages send data size (in byte) and send data.*1*2

*1 If bit device is specified, consecutive 4048 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, up to 4048 bits will be processed by crossing over to the next channel.

*2 If word device is specified, consecutive 253 words will be processed.

*3 EM, FM and ZF cannot be used with the KV Nano Series.

Operation Description

U_MSGSND If execution condition is ON, write S -byte send data stored in devices in turn from S + 1 in the buffer memory of No. n1 unit.

	Device No.	Buffer memory address
Send service data size (in byte)	S +0	#1900
Send service data	S +1 to	#1901 to

Example) write 5-byte send service data

S + 0	#5		#5		#1900
S + 1	22(H)	11(H)	22(H)	11(H)	#1901
S + 2	44(H)	33(H)	44(H)	33(H)	#1902
S + 3	-	55(H)	-	55(H)	#1903

@U_MSGSND Only one scan is executed at the rising edge of execution condition.

Operation flag

R2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON if any of the following conditions is met, otherwise it is OFF. • The unit No. specified by n1 is out of range. • The unit with the unit No. specified with n1 is not KV-EP21V, KV-5500 or KV-NC1EP. • From next No. of the device specified by S, S -byte devices can not be guaranteed. • The range of indirect specifying and index modification are inappropriate.

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

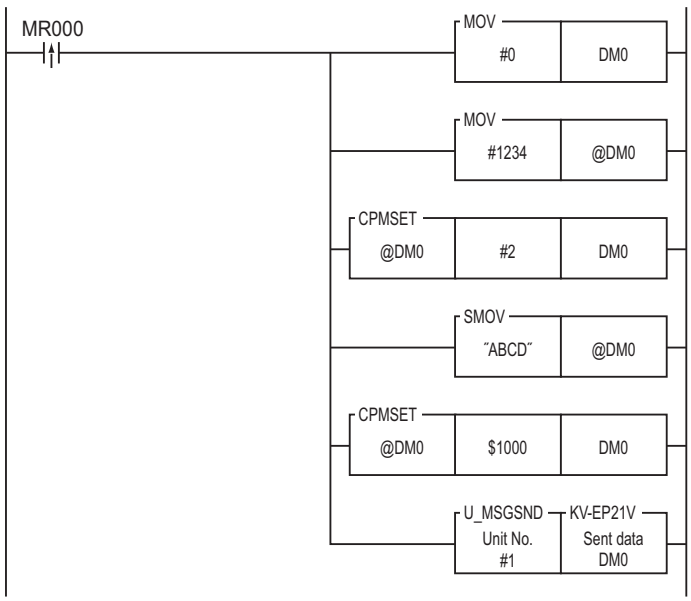
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

Sample Program

At the rising edge of MR000, write the sent data stored in data memories with DM0 as leading one in the buffer memory. In the sample program, CPMSET command (CIP message creation) is used to creat sent data as "1234 (16-bit unsigned data) + “ABCD” (CIP character string type data)".



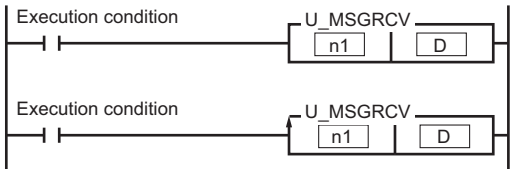
<Mnemonic list>

```
LDP MR000
MOV #0 DM0
MOV #1234 @DM0
CPMSET @DM0 #2 DM0
SMOV "ABCD" @DM0
CPMSET @DM0 $1000 DM0
U_MSGSND #1 DM0
```

U_MSGRCV / @U_MSGRCV

U_MSGRCV	U_MSGRCV(.U)	U_MSGRCV	Read explicit messages receive data
@U_MSGRCV	@U_MSGRCV(.U)	U_MSGRCV	Read explicit messages receive data from the buffer memory.

Ladder program



Input method

U_MSGRCV n1 D ↵

@U_MSGRCV n1 D ↵

Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
D	○	-	○	-	-	-	○	○	○*3	○	○	-	-	-	○	-	-	-	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
D	Specify the leading device to store Reception Service Data size (in byte) and Reception Service Data. *1*2

*1 If bit device is specified, consecutive 4048 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, up to 4048 bits will be processed by crossing over to the next channel.

*2 If word device is specified, consecutive 253 words will be processed.

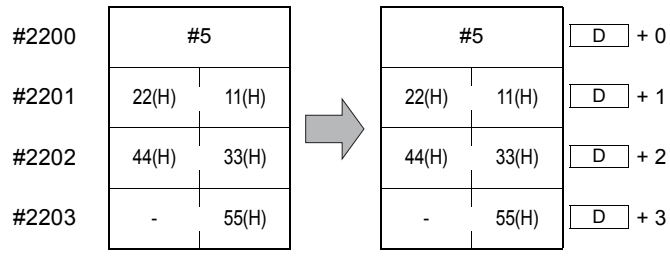
*3 EM, FM and ZF cannot be used with the KV Nano Series.

Operation Description

U_MSGRCV If execution condition is ON, read Reception Service Data from the buffer memory of No. n1 unit, store service data from D + 1 in turn to the reception service data size in D.

	Buffer memory address	Device No.
Reception Service data size (in byte)	#2200	D + 0
Reception Service data	#2201 to	D + 1 to

Example) read 5-byte Reception Service data



@U_MSGRCV Only one scan is executed at the rising edge of execution condition.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON if any of the following conditions are met, otherwise it is OFF. • The unit No. specified by n1 is out of range. • The unit with the unit No. specified with n1 is not KV-EP21V, KV-5500 or KV-NC1EP. • The consecutive 253-word devices from the device specified by D cannot be ensured. • The range of indirect specifying and index modification are inappropriate.

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

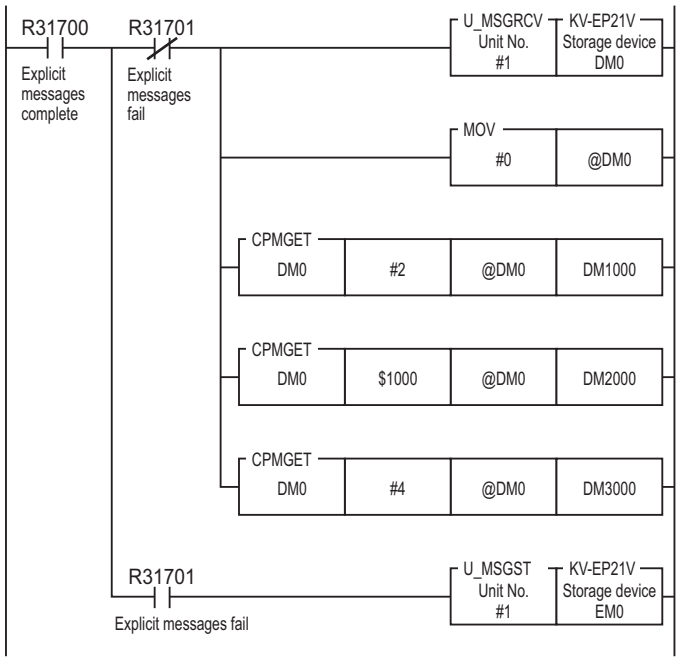
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

Sample Program

When explicit messages are completed, store Reception Service Data into DM0. If explicit messages fails, read complete code from EM0 (EM1). In the sample program, CPMGET command (CIP message acquisition) is used to convert the first 2-byte numerical data, and character string data to 4-byte numerical data from leading, and store it in DM1000, DM2000, and DM3000.



<Mnemonic list>

```
LD R31700
MPS
ANB R31701
U_MSGRCV #1 DM0
MOV #0 @DM0
CPMGET DM0 #2 @DM0 DM1000
CPMGET DM0 $1000 @DM0 DM2000
CPMGET DM0 #4 @DM0 DM3000
MPP
AND R31701
U_MSGST #1 EM0
```

U_MSGST / @U_MSGST

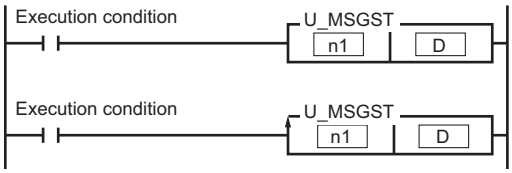
U_MSGST.(U) 

@U_MSGST(.U) 

Read explicit messages complete code

Read explicit messages complete code from the buffer memory.

Ladder program



Input method

U _ M S G S T ␣ n1 ␣ D ↵

@ U _ M S G S T ␣ n1 ␣ D ↵

Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
D	○	-	○	-	-	-	○	○	○*3	○	○	-	-	-	○	-	-	-	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
D	Specify the leading device to store complete code. *1*2

*1 If bit device is specified, consecutive 32 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 32 bits will be processed by crossing over to the next channel.

*2 If the word device is specified, consecutive 2 words will be processed. .

*3 EM, FM and ZF cannot be used with the KV Nano Series.

Operation Description

U_MSGST If execution condition is ON, read explicit messages complete code from No. n1 unit, and store it in 2-word devices with D as leading device.

Complete code	Buffer memory address	Device No.
Explicit messages complete code	#1810	D + 0
Explicit messages detailed complete code	#1811	D + 1

@U_MSGST Only one scan is executed at the rising edge of execution condition.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON if any of the following conditions are met, otherwise it is OFF. • The unit No. specified by n1 is out of range. • The unit with the unit No. specified with n1 is not KV-EP21V, KV-5500 or KV-NC1EP. • Consecutive 2-word devices from the device specified by D cannot be ensured. • The range of indirect specifying and index modification is inappropriate

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

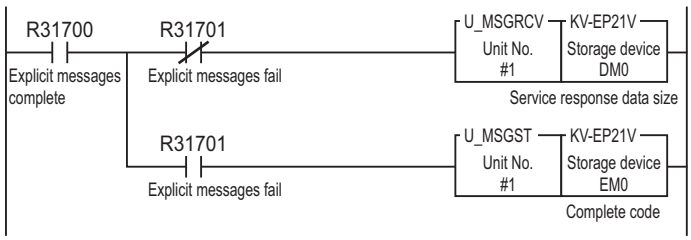
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

Sample Program

When explicit messages are completed, store Reception Service Data size in DM0, and store Reception Service Data in devices starting from DM1 in byte. If explicit messages fails, read complete code to EM0 (EM1).



<Mnemonic list>

```
LD R31700
MPS
ANB R31701
U_MSGRCV #1 DM0
MPP
AND R31701
U_MSGST #1 EM0
```

Unit-specific Function for Explicit Messages

■ Unit-specific function list for explicit messages

Function	Function	Operation	Page
Specify explicit messages object	U_MSGTO	Write explicit messages object setting in the buffer memory.	4-115
Write explicit messages send data	U_MSGSND	Write explicit messages send data in the buffer memory.	4-116
Read explicit messages receive data	U_MSGRCV	Read explicit messages receive data from the buffer memory.	4-117
Read explicit messages complete code	U_MSGST	Read explicit messages complete code and detailed code from the buffer memory.	4-118

U_MSGTO Specify explicit messages object

U_MSGTO ([execution condition]*1, unit No., explicit messages object)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No. *2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	-
S	Explicit messages object *3*4*5	Specify the leading device No. to store explicit messages object.	.U	.U	.U	.U	-	-	-	-	○	○	-

*1 [ ] can be omitted. (If execution condition is omitted, function is executed in each scanning.)
*2 $ (specify hex) cannot be used.
*3 CTC, CTH, and Z cannot be specified.
*4 If bit device is specified for S, consecutive 128 bits will be processed. Specify any relay (R002, R1012 etc) other than the leading one of the channel, 128 bits will be processed by crossing over to the next channel.
*5 If word device is specified for S, consecutive 8 words will be processed.

Operation Description

U_MSGTO If execution condition is ON, write 8-word explicit messages object setting stored in devices in turn from S in the buffer memory of No. n unit.

Device No.		Buffer memory address
IPaddress first byte	S +0	#1800
IPaddress second byte	S +1	#1801
IPaddress3 byte	S +2	#1802
IPaddress4 byte	S +3	#1803
Service code	S +4	#1804
ClassID	S +5	#1805
InstanceID	S +6	#1806
AttributeID	S +7	#1807

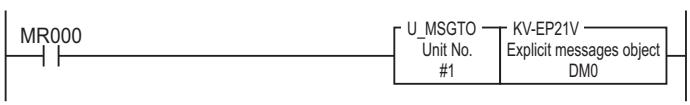
If constant is specified for S, the specified constant is stored in the 8-word buffer memories.

● Format example

Script programming U_MSGTO(MR0,1,DM0)

Operation description When MR000 is ON, specify explicit messages object setting as DM0 to DM7, and write it in the buffer memory.

Ladder conversion



U_MSGSND Write explicit messages send data

U_MSGSND ([execution condition]*1, unit No., send data)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No. *2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	-
S	Send data *3*4*5	Specify the leading device No. to store explicit messages send data size (in byte) and send data.	.U	.U	.U	.U	-	-	-	-	○	○	-

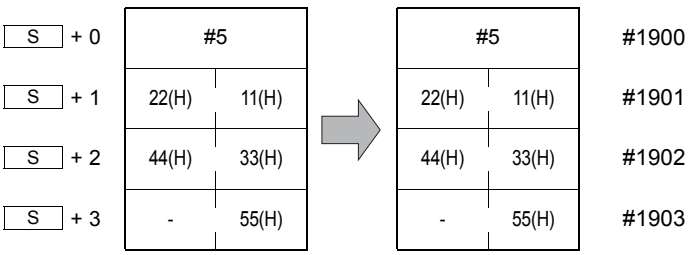
*1 [ ] can be omitted. (If execution condition is omitted, function is executed in each scanning.)
*2 $ (specify hex) cannot be used.
*3 CTC, CTH, and Z cannot be specified.
*4 If bit device is specified for S, consecutive 4048 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, up to 4048 bits will be processed by crossing over to the next channel.
*5 If word device is specified for S, consecutive 253 words will be processed.

Operation Description

U_MSGSND If execution condition is ON, write S -byte send data stored in devices starting from S + 1 in the buffer memory of No. n unit.

	Device No.	Buffer memory address
Send service data size (byte unit)	S +0	#1900
Send service data	S +1 to	#1901 to

Example) when writing 5-byte send service data



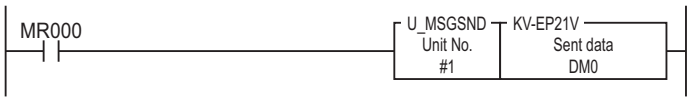
When specifying constant in S, write the specified constant in all buffer memories.

● Format example

Script programming U_MSGSND(MR0,1,DM0)

Operation description When MR000 is ON, write send data stored in data memories with DM0 as the first in the buffer memory.

Ladder conversion



U_MSGRCV Read explicit messages receive data

U_MSGRCV ([execution condition]*1, unit No., storage target device No.)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No. *2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	-
D	Storage target device No.*3*4*5	Specify the leading device No. to store Reception Service Data size (in byte) and Reception Service Data.	.U	.U	.U	.U	-	-	-	-	-	○	-

*1 [ ] can be omitted. (If execution condition is omitted, function is executed in each scanning.)

*2 $ (specify hex) cannot be used.

*3 CTC, CTH, and Z cannot be specified.

*4 If bit device is specified for D, consecutive 4048 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 4048 bits will be processed by crossing over to the next channel.

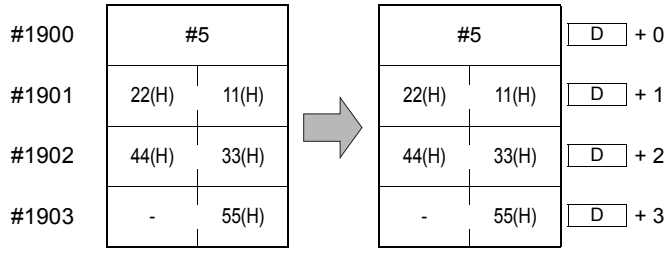
*5 If word device is specified for D, consecutive 253 words will be processed.

Operation Description

U_MSGRCV If execution condition is ON, read Reception Service Data from the buffer memory of No. n unit, store service data from D + 1 in turn to the reception service data size in D .

	Buffer memory address	Device No.
Reception Service data size (in byte)	#2200	D + 0
Reception Service data	#2201 to	D + 1 to

Example) read 5-byte Reception Service data

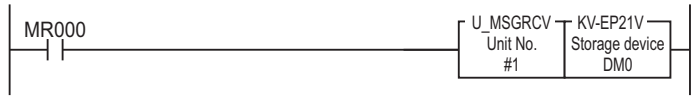


- **Format example**

Script programming U_MSGRCV(MR0,1,DM0)

Operation description When MR000 is ON, store Reception Service Data size in DM0, and store Reception Service Data in devices starting from DM1 in byte in turn.

Ladder conversion



U_MSGST Read explicit messages complete code

U_MSGST ([execution condition]*1, unit No., storage target device No.)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No. *2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	-
D	Storage target device*3*4*5	Specify the leading device No. to store complete code.	.U	.U	.U	.U	-	-	-	-	-	○	-

*1 [ ] can be omitted. (If execution condition is omitted, function is executed in each scanning.)
*2 $ (specify hex) cannot be used.
*3 CTC, CTH, and Z cannot be specified.
*4 If bit device is specified for D, consecutive 32 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 32 bits will be processed by crossing over to the next channel.
*5 If word device is specified for D, consecutive 2 words will be processed.

Operation Description

U_MSGST If execution condition is ON, read explicit messages complete code from No. n unit, and store in 2-word devices with D as the leading devices.

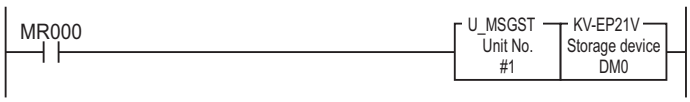
Complete code	Buffer memory address	Device No.
Explicit messages complete code	#1810	D + 0
Explicit messages detailed complete code	#1811	D + 1

● Format example

Script programming U_MSGST(MR0,1,DM0)

Operation description When MR000 is ON, store explicit messages complete code in DM0 to DM1.

Ladder conversion



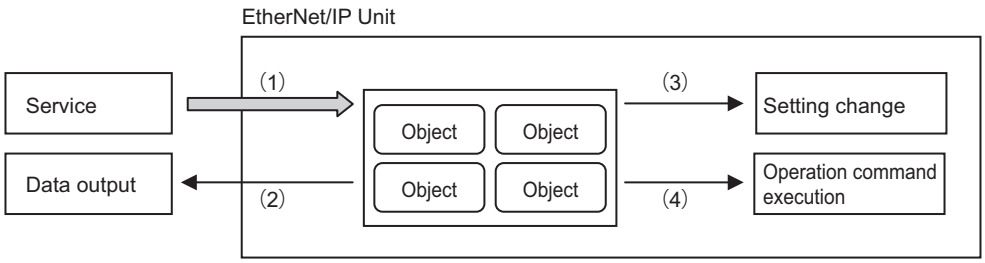
4-5 Explicit Messages (Server) Function

This section describes explicit messages (server) function of EtherNet/IP communication.

Overview

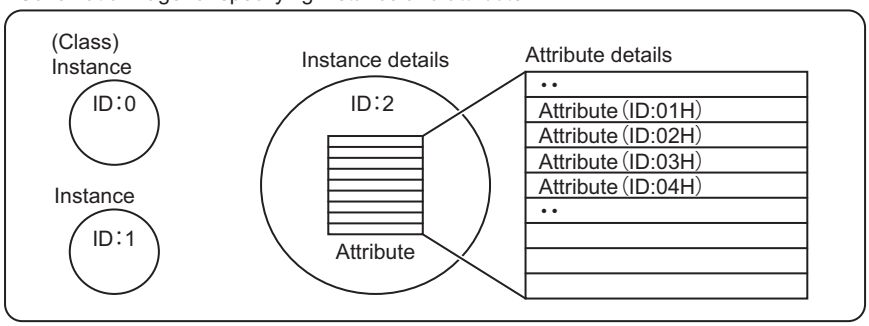
As EtherNet/IP Units support object and service, explicit messages can be executed from other EtherNet/IP Devices to execute services provided by EtherNet/IP Units.
Object represents function or data of EtherNet/IP Device in abstract way, Class ID, Instance ID, and Attribute ID are used for specifying the object. for example, to read data, service (Get_Attribute_Single: 0EH) for reading data can be used, Class ID, instance ID, and attribute ID can be used to specify data etc. Services that do not need instance ID or attribute ID also exist.

If EtherNet/IP Device executes (1) service for the object, (2) data output, (3) setting change, or (4) execution the specified operation will be executed.



The objects having the same components are classified as a “Class”. The entities belonging to a class are called “instance”. Instance is identified by instance ID (instance ID = 0 has special meaning, i.e., referring to the class itself). In addition, each object contains the variable information called “attribute” internally.

Schematic image for specifying instance and attribute



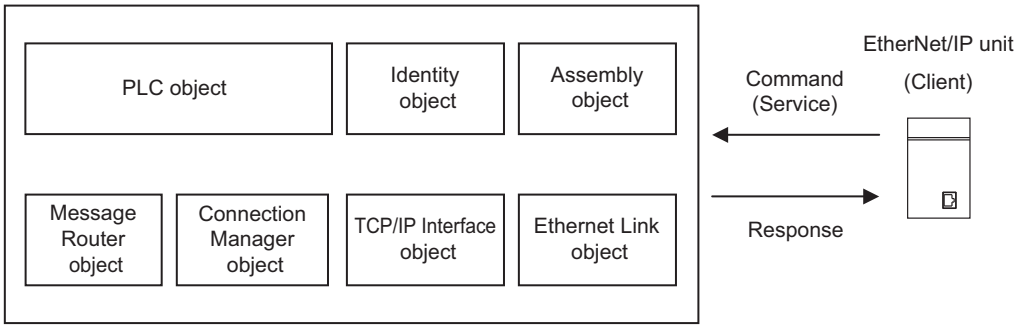
Point

- **The explicit messages (server) function of EtherNet/IP Units is available in CIP UCMM (nonconnection) and Class3 (connection) modes.**
- **When the explicit messages (server) function is used, the IP address of the EtherNet/IP Unit should be specified from the EtherNet/IP Device serving as a client to execute explicit messages. It is unnecessary for the EtherNet/IP Device serving as a client to be registered in the scan list.**

■ Object list of explicit messages (server) function

The following describes the list of objects available for EtherNet/IP Units.

EtherNet/IP Unit (Server)



Object name	Class code	Description	See page
PLC	65H	The object is used to provide the status of CPU units connected with the EtherNet/IP Unit or write/read device. It is an object unique to the EtherNet/IP Unit.	4-126
Identity	01H	The object is used to provide identification information, general information and reset service etc. of EtherNet/IP Units.	4-140
Message Router	02H	The object is used to manage the received messages.	4-143
Assembly	04H	The object is used to access the devices assigned to the EtherNet/IP Unit tag setting. Access is available cyclic (I/O) messages and explicit messages.	4-144
Connection Manager	06H	The object is used for connection type communication.	4-145
TCP/IP Interface	F5H	The object is used to provide the mechanism for setting the TCP/IP network interface. IP address, subnet mask, and default gateway can be set.	4-147
Ethernet Link	F6H	The object is used to provide Ethernet status information.	4-150

Unit Editor Setting Related with Explicit Messages (Server) Function

The following describes the settings of Unit Editor of KV STUDIO related with explicit messages (server) function.

For other setting items in “Basic” of the Unit Editor, please set to appropriate value as required.

"Setting Item List", page 3-4

Unit Editor setting

Item	Setting range	Default value	Related page
"Basic"			
Baud rate	"100/10Mbps automatic"/"10Mbps"	100/10Mbps automatic	3-6
Setting method of IP address	Fixed IP address/BOOTP/Fixed IP Auto switching/BOOTP	Fixed IP address	3-6
IP address	(0 to 255).(0 to 255).(0 to 255).(0 to 255)	192.168.0.10	3-7
Subnet mask	(0 to 255).(0 to 255).(0 to 255).(0 to 255)	255.255.255.0	3-7

Communication Format and Processing Flow

■ Communication format

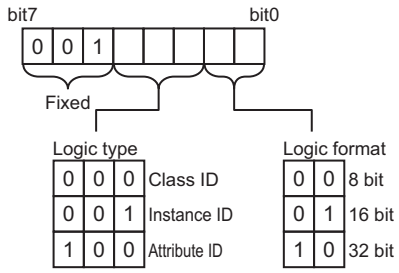
● Command format

ServiceCode	Size*1	ClassID*2*3	InstanceID*2	AttributeID*2	ServiceData*4

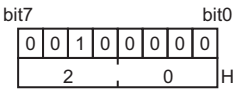
*1 Size is the total size of Class ID, Instance ID, and Attribute ID, and is specified in word.

*2 Logic segment (1 byte) is required for Class ID, Instance ID, and Attribute ID. Logic segment is specified as follows according to the size of the specified Class ID, Instance ID, and Attribute ID.

Logic segment (1 byte)



Example) When specifying PLC object (class ID: 65H), logic segment becomes



Class ID is specified as 2065H (2 bytes).

*3 If Class ID is omitted, 05H (Path Destination Unknown) is returned to General Status.

*4 ServiceData is byte array of Little-Endian format.
For data type and device storage format in EtherNet/IP communication, see "Data Type and Device Storage Mode", page 4-172.

Reference Explicit messages commands received by the EtherNet/IP Unit are processed according to the order in which each object was received. For the same Attribute, when commands are sent from multiple units, the command sent later will be reserved until the previous processing is ended.

● Response format

ServiceCode*1	00H (fixed value)	General Status*2	Size*3	Additional Status*2	Reception Service Data*4

*1 The most significant bit of ServiceCode command is set to 1 return.
(Example) when ServiceCode command is 0 EH, ServiceCode response is 8EH.

*2 For error details specified by CIP, see "CIP General Status List", page 4-153.

*3 Additional Status size is stored in word.

*4 ServiceResponseData is byte array of Little Endian format.
For data type and device storage format in EtherNet/IP communication, see "Data Type and Device Storage Mode", page 4-172.

● Usage example

Example) use PLC object to read operating mode of CPU unit.

The command used

Item	Data	Description
ServiceCode	0EH	Specify Get_Attribute_Single (0EH).
ClassID	65H	Specify PLC object (65H).
InstatnceID	00H	Specify 00H. (fixed value)
AttributeID	65H	Specify operating mode (65H).
ServiceData	-	Invalid (can be omitted)

Command format

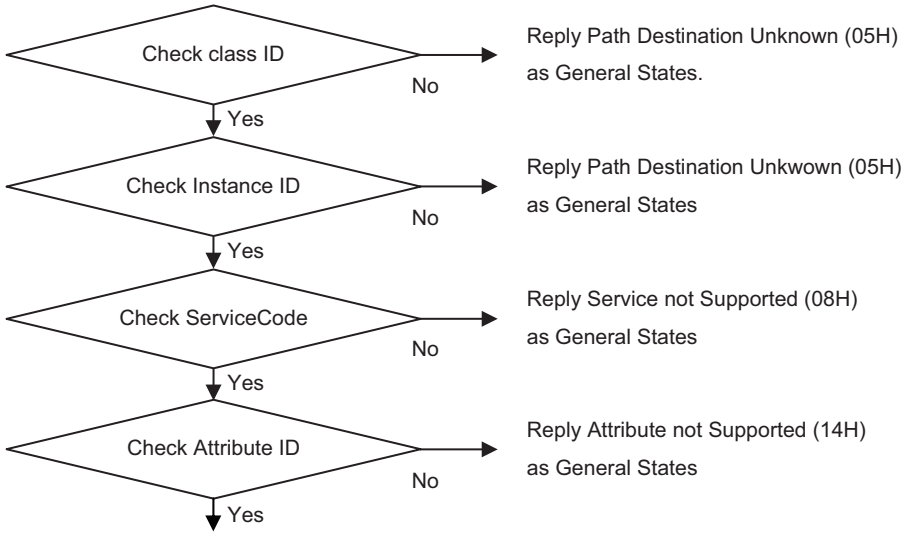
ServiceCode	Size	ClassID		InstanceID		AttributeID		ServiceData
0EH	03H	20H*	65H	24H*	00H	30H*	65H	Setting not required

* Logic segment of Class ID, instanceid, and AttributeID should be added respectively. For logic segment, see "Command format", page 4-122.

Response (in case of success)

ServiceCode	00H (fixed value)	General Status	Size	Additional Status	ServiceResponseData
8EH	00H	00H	-	-	00H:PROGRAM 01H:RUN

■ Command processing sequence and error response



● Supplementary matters for object processing

- Send service data is ignored when executing to execute Get_Attribute_Single and Get_Attributes_All.
- When executing services (Get_Attributes_All, Reset) with AttributeID not specified, AttributeID will be ignored.
- When specifying Set_Attribute_Single for Attribute that can not be set, 0EH (Attribute not settable), or 08H (Service not Supported) will be returned.
- When specifying Set_Attribute_Single for settable Attribute, and the written size is less than Attribute size, General Status 13H (Not enough data) will be returned. If written size is larger than Attribute size, objects other than PLC object will be executed in the Attribute size.
- If the incorrect service code (80H to FFH) is specified, the command will be ignored and no response is returned.

How to Use Object Table

How to use class attribute/instance attribute

Example) Extracts from class attribute of Identify object

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Attribute ID	**Attribute**	**In case of power off**	**Name**	**Data type**	**Description**	**Response**
1	R		Revision	UINT	Object revision	0001H
2	R		Max Instance	UINT	The largest instance No.	0001H
3	R		Number of Instances	UINT	Number of instances of the generated object	0001H

Item	Description
(1) AttributeID	Attribute ID is represented by decimal number.
(2) Attribute	It represents service direction against attribute ID. R (read): Get_Attribute_Single can be used to read the value of attribute. W (write): Set_Attribute_Single can be used to write the value in attribute.
(3) in case of power off	It represents data hold setting of attribute in case of power off. Hold : hold value in case of power off. (Blank) : does not hold value, or attribute R in case of power off.
(4) Name	It displays attribute name.
(5) Data type	It displays data type of attribute.
(6) Description	It displays attribute description.
(7) response	It displays the data read from attribute.

*1 Data type as followings according to CIP specification.
For data type other than those in the table below, see CIP specification.

Data type	Data size	Description	Range
BOOL	1 byte	Boolean	0 : FALSE(OFF)/1 : TRUE(ON)
SINT	1 byte	Singed 8-bit data	-128 to 127
INT	2 bytes	Singed 16-bit data	-32768 to 32767
DINT	4 bytes	Singed 32-bit data	-2147483648 to 2147483647
USINT	1 byte	Singed 8-bit data	0 to 255
UINT	2 bytes	Singed 16-bit data	0 to 65535
UDINT	4 bytes	Singed 32-bit data	0 to 4294967295
REAL	4 bytes	Single floating real number	*1
LREAL	8 bytes	Double floating real number	*2
STRING	-*3	CIP character string type data	-
BYTE	1 byte	Bit array: 8 bits	-
WORD	2 bytes	Bit array: 16 bits	-
DWORD	4 bytes	Bit array: 32 bits	-

*1 -3.4E38<=N<=-1.4E-45, N=0, +1.4E-45<=N<=+3.4E38

*2 -1.79E+308<=N<=-2.23E-308, N=0, 2.23E-308<=N<=1.79E+308

*3 It varies with the size of character string.

PLC Object (Class ID: 65H)

The object is used to provide the status of CPU units connected to the EtherNet/IP Unit or write/read device. It is an object unique to the EtherNet/IP Unit.

■ Class

● Class service (Instance ID: 0)

Code	Service name	Description	Page
0EH	Get_Attribute_Single	Specify class attribute and read it.	4-127 4-128 4-129
4BH	Read consecutive data	Read data of device in specified number consecutively.	4-131
4CH	Write consecutive data	Write data of device in specified number consecutively.	4-132
4DH	Read expansion unit buffer memory	Read data of expansion unit buffer memory in specified number consecutively.	4-133
4EH	Write expansion unit buffer memory	Write data of expansion unit buffer memory in specified number consecutively.	4-134
4FH	Change operating mode	Change operating mode of PLC (RUN/PROG).	4-130
50H	Clear error	Clear PLC error.	4-130

● Class attribute

Attribute ID	Attribute	In case of power off	Name	Data type	Description	Response
100	R		Model	USINT	PLC model	33H:KV-3000 34H:KV-5000 35H:KV-5500 80H:KV-NC32 84H:KV-N60** 85H:KV-N40** 86H:KV-N24**
101	R		Operating mode	USINT	PLC operating mode	00H:PROGRAM 01H:RUN
102	R		Error No.	USINT	PLC error No.	Error No.

■ Instance

● Instance service/instance attribute

There is no instance service/instance attribute.

■ PLC object Class service details

When class service of PLC object is used, instance ID should be specified as 0.

● Read model (Get_Attribute_Single (0EH))

Get_Attribute_Single can be used to read CPU unit model.

• Command

Item	Data example	Description
ServiceCode	0EH	Specify Get_Attribute_Single. (fixed value)
ClassID	65H	Specify PLC object. (fixed value)
InstatnceID	00H	Specify 00H. (fixed value)
AttributeID	64H	Specify PLC model. (fixed value)
ServiceData	-	Invalid (can be omitted)

• Response (in case of success)

Item	Data example	Description
GeneralStatus	00H	OK
ResponseServiceData		
0 byte	33H	CPU model is returned. 33H:KV-3000/34H:KV-5000/35H:KV-5500/80H:KV-NC32/ 84H:KV-N60**/85H:KV-N40**/86H:KV-N24**

• Response (in case of failure)

Item	Data example	Description
GeneralStatus	10H	Error response is returned. 10H (Device State Conflict): bus communication error occurs.
AdditionalStatus	0000H	Fixed value.

● Read operating mode (Get_Attribute_Single (0EH))

Get_Attribute_Single is used to read operating mode of CPU unit.

• Command

Item	Data example	Description
ServiceCode	0EH	Specify Get_Attribute_Single. (fixed value)
ClassID	65H	Specify PLC object. (fixed value)
InstatnceID	00H	Specify 00H. (fixed value)
AttributeID	65H	Specify operating mode. (fixed value)
ServiceData	-	Invalid (can be omitted)

• Response (in case of success)

Item	Data example	Description
GeneralStatus	00H	OK
ResponseServiceData		
0 byte	01H	Operating mode is returned. 00H: PROGRAM mode/01H: RUN mode

• Response (in case of failure)

Item	Data example	Description
GeneralStatus	10H	Error response is returned. 10H (Device State Conflict): bus communication error occurs.
AdditionalStatus	0000H	Fixed value.

● Read error No. (Get_Attribute_Single (0EH))

Get_Attribute_Single is used to read error No. of CPU unit.

For error No. of CPU unit, see 🕮 "KV-5500/5000/3000 User's Manual".

• Command

Item	Data example	Description
ServiceCode	0EH	Specify Get_Attribute_Single. (fixed value)
ClassID	65H	Specify PLC object. (fixed value)
InstatnceID	00H	Specify 00H. (fixed value)
AttributeID	66H	Specify error No.. (fixed value)
ServiceData	-	Not required (can be omitted)

• Response (in case of success)

Item	Data example	Description
GeneralStatus	00H	OK
ResponseServiceData		
0 byte	01H	Error No. is returned.

• Response (in case of failure)

Item	Data example	Description
GeneralStatus	10H	Error response is returned. 10H (Device State Conflict): bus communication error occurs.
AdditionalStatus	0000H	Fixed value.

● Change operating mode (4FH)

Operating mode change service is used to switch operating mode (RUN/PROG) of CPU unit.

• Command

Item	Data example	Description
ServiceCode	4FH	Specify operating mode change. (fixed value)
ClassID	65H	Specify PLC object. (fixed value)
InstatnceID	00H	Specify 00H. (fixed value)
AttributeID	-	Invalid (can be omitted)
ServiceData		
0 byte	00H	Specify operating mode. 00H: PROGRAM mode/01H: RUN mode

• Response (in case of success)

Item	Data example	Description
GeneralStatus	00H	OK

• Response (in case of failure)

Item	Data example	Description
GeneralStatus	10H	Error response is returned. *
AdditionalStatus	0000H	Fixed value.

* 09H (Invalid attribute value): values other than 00H and 01H are specified for service data.
10H (Device State Conflict) : during bus communication error, DIP switch is in PROG mode, or mode cannot be changed.
13H (Not enough data) : service data are not specified.
15H (Too much data) : more than 2-byte data are specified for service data.

● Clear error (50H)

Clear error service is used to clear CPU unit error.

• Command

Item	Data example	Description
ServiceCode	50H	Specify clear error. (fixed value)
ClassID	65H	Specify PLC object. (fixed value)
InstatnceID	00H	Specify 00H. (fixed value)
AttributeID	-	Invalid (can be omitted)

• Response (in case of success)

Item	Data example	Description
GeneralStatus	00H	OK

• Response (in case of failure)

Item	Data example	Description
GeneralStatus	10H	Error response is returned. 10H (Device State Conflict): bus communication error occurs.
AdditionalStatus	0000H	Fixed value.

● Read consecutive data (4BH)

Read consecutive data service is used to read data of device in the specified number consecutively. Synchronism of 2-word data can be ensured.

• Command

Item	Data example	Description
ServiceCode	4BH	Specify read consecutive data. (fixed value)
ClassID	65H	Specify PLC object. (fixed value)
InstatnceID	00H	Specify 00H. (fixed value)
AttributeID	-	Invalid (can be omitted)
ServiceData		
0 byte	00H	Specify the device code. (device type is R in the data example) "Device data format", page 4-135
1st byte	00H	Specify data format. 00H: default value/01H: word/02H: 2-word/03H: bit
2nd byte	05H	Use 2 bytes to specify the number of devices. Bit: 1-400/word: 1-200/2-word: 1-100 When reading T/C/CTH/CTC in word: 1-100 When reading T/C/CTH/CTC in 2-word: 1-50 (In case of 5 bits)
3rd byte	00H	
4th byte	05H	Use 4 bytes to specify leading device No.. (device No. is 5 in the data example)
5th byte	00H	
6th byte	00H	
7th byte	00H	

• Response (in case of success)

Item	Data example	Description	
GeneralStatus	00H	OK	
ResponseServiceData			
0 byte	01H	R5 is ON (Data example)	The read data behind 0 byte are stored in the sequence of lower bytes and upper byte.
1st byte	00H	R6 is ON (Data example)	
2nd byte	01H	R7 is ON (Data example)	
3rd byte	00H	R8 is ON (Data example)	
4th byte	01H	R9 is ON (Data example)	

• Response (in case of failure)

Item	Data example	Description
GeneralStatus	10H	Error response is returned. *
AdditionalStatus	0000H	Fixed value.

* 10H (Device State Conflict) : bus communication error occurs.
13H (Not enough data) : the specified service data size is too small.
15H (Too much data) : the specified service data size is too large.
20H (Invalid parameter) : the specified device No., number of devices, device code, or data format is out of range.

● Write consecutive data (4CH)

Write consecutive data service is used to write data of device in specified number consecutively.
Synchronism of 2-word data can be ensured.
For device write examples, see "Write device", page 4-137.

• Command

Item	Data example	Description	
ServiceCode	4CH	Speicfy write consecutive data. (fixed value)	
ClassID	65H	Select PLC object. (fixed value)	
InstatnceID	00H	Select 00H. (fixed value)	
AttributeID	-	Invalid (can be omitted)	
ServiceData			
0 byte	06H	Specify the device code. (device type is DM in the data example) "Device data format", page 4-135	
1st byte	00H	Specify data format. 00H: default value/01: word/02: 2-word/03: bit	
2nd byte	02H	Use 2 bytes to specify the number of devices. Bit: 1-400/word: 1-200/2-word: 1-100	
3rd byte	00H	When reading T/C/CTH/CTC in word: 1-100 When reading T/C/CTH/CTC in 2-word: 1-50	
4th byte	10H	Use 4 bytes to specify leading device No.. (device No. is 10000 (2710H) in the data example)	
5th byte	27H		
6th byte	00H		
7th byte	00H		
8th byte	11H	Specify 2211H to DM10000	Specify the data to write in DM10000 and DM10001.
9th byte	22H		
10th byte	33H	Specify 4433H to DM10001	
11th byte	44H		

• Response (in case of success)

Item	Data example	Description
GeneralStatus	00H	OK

• Response (in case of failure)

Item	Data example	Description
GeneralStatus	10H	Error response is returned. *
AdditionalStatus	0000H	Fixed value.

* 10H (Device State Conflict) : bus communication error occurs, or write protection is enabled on CPU unit side. Unwrittable device (unregistered timer etc) is specified.
13H (Not enough data) : the specified service data size is too small.
15H (Too much data) : the specified service data size is too large.
20H (Invalid parameter) : the specified device No., number of devices, device code, or data format is out of range.

● Read expansion unit buffer memory (4DH)

Read expansion unit buffer memory service is used to read data of expansion unit buffer memories in specified number consecutively. Synchronism of 2-word data can be ensured.

• Command

Item	Data example	Description
ServiceCode	4DH	Specify read expansion of unit buffer memory. (fixed value)
ClassID	65H	Specify PLC object. (fixed value)
InstatnceID	00H	Specify 00H. (fixed value)
AttributeID	-	Invalid (can be omitted)
ServiceData		
0 byte	01H	Specify unit No.. When KV-5500 is specified, specify 0.
1st byte	00H	Specify data format. 00H: default value (word)/01H: word/02H: 2-word
2nd byte	10H	Use 2 bytes to specify the number of addresses to be read.
3rd byte	00H	Word: 1-200/2-word: 1-100 (16 (0010H) is the data example)
4th byte	40H	Use 4 bytes to specify the leading address. (buffer memory address is #1600 (660H) in the data example)
5th byte	06H	
6th byte	00H	
7th byte	00H	

• Response (in case of success)

Item	Data example	Description	
GeneralStatus	00H	OK	
ResponseServiceData			
0 byte	11H	Store the value of	Store the read data behind 0 byte in buffer memories from the leading address in turn.
1 byte	22H	#1600(2211H)	
2 byte	33H	Store the value of	
3 byte	44H	#1601(4433H)	
to	to	to	

• Response (in case of failure)

Item	Data example	Description
GeneralStatus	10H	Error response is returned. *
AdditionalStatus	0000H	Fixed value.

* 10H (Device State Conflict) : bus communication error occurs.
13H (Not enough data) : the specified service data size is too small.
15H (Too much data) : the specified service data size is too large.
20H (Invalid parameter) : the specified leading address, number of addresses, data format, or unit No. is out of range.

● Write expansion unit buffer memory (4EH)

Write expansion unit buffer memory service is used to write data consecutively in the expansion unit buffer memories of specified quantity. Synchronism of 2-word data can be ensured.

For device write examples, see 🕮 "Write device", page 4-137.

• Command

Item	Data example	Description	
ServiceCode	4EH	Specify write expansion unit buffer memory. (fixed value)	
ClassID	65H	Specify PLC object. (fixed value)	
InstatnceID	00H	Specify 00H. (fixed value)	
AttributeID	-	Invalid (can be omitted)	
ServiceData			
0 byte	01H	Specify unit No.. When KV-5500 is specified, specify 0.	
1 byte	00H	Specify data format. 00H: default value (word)/01H: word/02H: 2-word	
2 byte	10H	Use 2 bytes to specify the number of addresses to be written.	
3 byte	00H	Word: 1-200/2-word: 1-100 (16 (0010H) is the data example)	
4 byte	60H	Use 4 bytes to specify the leading address. (buffer memory address is #1632 (660H) in the data example)	
5 byte	06H		
6 byte	00H		
7 byte	00H		
8 byte	11H	Specify 2211H to #1632	Store the written data behind the 8th byte in buffer memories from the leading address in turn.
9 byte	22H		
10 byte	33H	Specify 4433H to #1633	
11 byte	44H		
to	to	to	

• Response (in case of success)

Item	Data example	Description
GeneralStatus	00H	OK

• Response (in case of failure)

Item	Data example	Description
GeneralStatus	10H	Error response is returned. *
AdditionalStatus	0000H	Fixed value.

* 10H (Device State Conflict) : bus communication error occurs.
13H (Not enough data) : the specified service data size is too small.
15H (Too much data) : the specified service data size is too large.
20H (Invalid parameter) : the specified leading address, number of addresses, data format, or unit No. is out of range.

● Device data format

The following describes the format when specifying device or data for class service of PLC object.

• Device data format list (for KV-EP21V and KV-5500)

Use the following device code, device No., and data format to specify device.

Device type		Device code	Device No.	Specify data format			
Device name				Default value	Word	2- word	Bit
Relay	R	00H	00000 to 99915	Bit	○	○	○
Link relay	B	1BH	0000 to 3FFF	Bit	○	○	○
Internal auxiliary relay	MR	11H	00000 to 99915	Bit	○	○	○
Latch relay	LR	12H	00000 to 99915	Bit	○	○	○
Control relay	CR	01H	0000 to 3915	Bit	○	○	○
Work relay	VB	14H	0000 to 3FFF	Bit	○	○	○
Data memory	DM	06H	00000 to 65534	Word	○	○	×
Extended data memory	EM	17H	00000 to 65534	Word	○	○	×
File register	FM	19H	00000 to 32767	Word	○	○	×
	ZF	2CH	000000 to 131071	Word	○	○	×
Link relay	W	1CH	0000 to 3FFF	Word	○	○	×
Temporary data memory	TM	08H	000 to 511	Word	○	○	×
Index register	Z	30H	01 to 12	2-word	○	○	×
Timer	T	02H	0000 to 3999	2-word	○	○	○
Timer (current value)	TC	20H	0000 to 3999	2-word	○	○	×
Timer (set value)	TS	21H	0000 to 3999	2-word	○	○	×
Counter	C	03H	0000 to 3999	2-word	○	○	○
Counter (current value)	CC	22H	0000 to 3999	2-word	○	○	×
Counter (set value)	CS	23H	0000 to 3999	2-word	○	○	×
High-speed counter	CTH	04H	0 to 1	2-word	○	○	○
High-speed counter comparator	CTC	05H	0 to 3	2-word	○	○	○
Digital trimmer	AT	26H	0 to 7	2-word	○	○	×
Control memory	CM	07H	0000 to 5999	Word	○	○	×
Work memory	VM	1EH	00000 to 59999	Word	○	○	×

• Device data format list (for KV-NC1EP)

Use the following device codes, device No., and data formats to specify devices.

Device type		Device code	Device No.	Specify data format			
Device name				Default value	Word	2- word	Bit
Relay	R	00H	00000 to 59915	Bit	○	○	○
Link relay	B	1BH	0000 to 1FFF	Bit	○	○	○
Internal auxiliary relay	MR	11H	00000 to 59915	Bit	○	○	○
Latch relay	LR	12H	00000 to 19915	Bit	○	○	○
Control relay	CR	01H	0000 to 8915	Bit	○	○	○
Work relay	VB	14H	0000 to 3FFF	Bit	○	○	○
Data memory	DM	06H	00000 to 32767	Word	○	○	×
Link register	W	1CH	0000 to 3FFF	Word	○	○	×
Temporary data memory	TM	08H	000 to 511	Word	○	○	×
Index register	Z	30H	01 to 12	2-Word	○	○	×
Timer	T	02H	000 to 511	2-Word	○	○	○
Timer (current value)	TC	20H	000 to 511	2-Word	○	○	×
Timer (set value)	TS	21H	000 to 511	2-Word	○	○	×
Counter	C	03H	000 to 255	2-Word	○	○	○
Counter (current value)	CC	22H	000 to 255	2-Word	○	○	×
Counter (set value)	CS	23H	000 to 255	2-Word	○	○	×
High-speed counter	CTH	04H	0 to 2	2-Word	○	○	○
High-speed counter comparator	CTC	05H	0 to 5	2-Word	○	○	○
Control memory	CM	07H	0000 to 8999	Word	○	○	×
Work memory	VM	1EH	00000 to 59999	Word	○	○	×

• Data format and specifiable number of data

Data code of the data format and number of data that can be specified.

Data format	Data code	Number of data can be specified
Default value	00H	It varies with data format.
Word	01H	1-200 * It is 1-100 when T/C/CTH/CTC is specified
2-word	02H	1-100 * It is 1-50 when T/C/CTH/CTC is specified
Bit	03H	1 to 400

• Precautions when T, C, CTH, or CTC is used in data format

To read write T, C, CTH, CTC, the following data are used.

- In case of read

  2-word : occupy 9 bytes, read in the sequence of contact (1 byte), current value (4 bytes), set value (4 bytes) from leading device.

  Word : occupy 5 bytes, read in the sequence of contact (1 byte), lower 16 bits (2 bytes) of current value, lower 16 bits (2 bytes) of set value from leading device.

  Bit : occupy 1 byte, read contact (1 byte).

- In case of write

  2 word : occupy 4 bytes, write to current value (T, C, CTH) or set value (CTC).

  Word : occupy 2 bytes, write to lower bits of current value (T, C, CTH) or set value (CTC).

  Bit : occupy 1 byte, set contact (1 byte) to ON/OFF.

● Write device

• Write bit device in bit

When specifying the bit device bit, specify 1 byte (8 bits) for 1 device, specify "1" for ON, specify "0" for OFF.

Example) when write ON/OFF of 4 devices from R5

Sent data

		Service Data	
(0 byte)	Device code	00H	Relay (R)
(1st byte)	Data format	00H	Default value (in bit)
(2nd byte)	Number of devices	04H	Specify 0004H (2 bytes) as 4
(3rd byte)		00H	
(4th byte)	Leading device	05H	Specify 00000005H (4 bytes) as 5
(5th byte)		00H	
(6th byte)		00H	
(7th byte)		00H	
(8th byte)	Data (R5)	01H	→ Set R5 to ON
(9th byte)	Data (R6)	00H	→ Set R6 to OFF
(10th byte)	Data (R7)	01H	→ Set R7 to ON
(11th byte)	Data (R8)	00H	→ Set R8 to OFF

• Write bit device in word

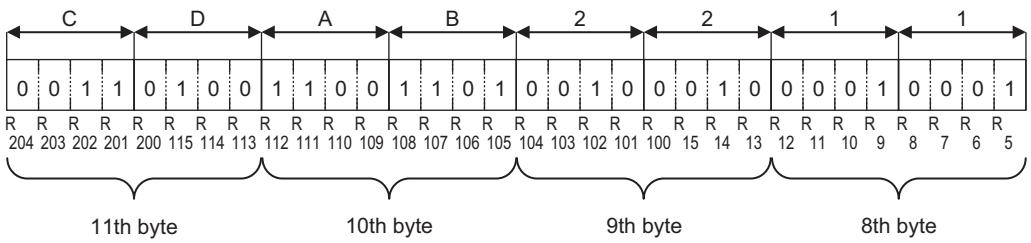
When specifying the bit device in word, specify 16 bits in word, specify in the sequence of lower bytes (bit 0-7), and upper bytes (bit 8-15).

Example) write ON/OFF of 2-word (32 bits) devices in word from R5

Sent data

		Service Data	
(0 byte)	Device code	00H	Relay (R)
(1st byte)	Data format	01H	Unit: word
(2nd byte)	Number of devices	02H	Specify 0002H (2 bytes) as 2
(3rd byte)		00H	
(4th byte)	Leading device	05H	Specify 00000005H (4 bytes) as 5
(5th byte)		00H	
(6th byte)		00H	
(7th byte)		00H	
(8th byte)	Data（R5 to 12）	11H	Store 11H in R5 to R12 (1 byte)
(9th byte)	Data（R13 to 104）	22H	Store 22H in R13 to R104 (1 byte)
(10th byte)	Data（R105 to 112）	ABH	Store ABH in R105 to R112 (1 byte)
(11th byte)	Data（R113 to 124）	CDH	Store CDH in R113 to R204 (1 byte)

Specifying method of device



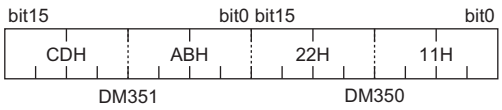
• Write in word device

Word device is specified according to the specified number of devices in the sequence of lower bytes (bit 0-7), and upper bytes (bit 8-15).

Example) write 2-word data from DM350 (in word)

	Sent data	Service Data	
(0 byte)	Device code	06H	Data memory (DM)
(1st byte)	Data format	01H	Unit: word
(2nd byte)	Number of devices	02H	Specify 0002H (2 bytes) as 2
(3rd byte)		00H	
(4th byte)	Leading device	5EH	Specify 0000015EH (4 bytes) as 350
(5th byte)		01H	
(6th byte)		00H	
(7th byte)		00H	
(8th byte)	Data (lower byte of DM350)	11H	Store 2211H in 2211H
(9th byte)	Data (upper byte of DM350)	22H	
(10th byte)	Data (lower byte of DM351)	ABH	Store CDABH in DM351
(11th byte)	Data (upper byte of DM351)	CDH	

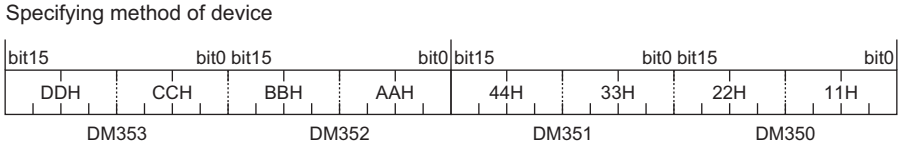
Specifying method of device



Example) write 4-word data from DM350 (in 2-word)

	Sent data	Service Data	
(0 byte)	Device code	06H	Data memory (DM)
(1st byte)	Data format	02H	Unit: 2-word
(2nd byte)	Number of devices	02H	Specify 0002H (2 bytes) as 2
(3rd byte)		00H	
(4th byte)	Leading device	5EH	Specify 0000015EH (4 bytes) as 350
(5th byte)		01H	
(6th byte)		00H	
(7th byte)		00H	
(8th byte)	Data (lower byte of DM350)	11H	Store 44332211H in DM351/DM350
(9th byte)	Data (upper byte of DM350)	22H	
(10th byte)	Data (lower byte of DM351)	33H	
(11th byte)	Data (upper byte of DM351)	44H	
(12th byte)	Data (lower byte of DM352)	AAH	Store DDCCBBAAH in DM353/DM352
(13th byte)	Data (upper byte of DM352)	BBH	
(14th byte)	Data (lower byte of DM353)	CCH	
(15th byte)	Data (upper byte of DM353)	DDH	

Specifying method of device



Identity Object (Class ID: 01H)

The object is used to provide identification information, general information and reset service etc. of EtherNet/IP Units.

■ Class

● Class service

Get_Attribute_Single (0EH) and Get_Attributes_All (01H) are supported.

● Class attribute (instance ID: 0)

Attribute ID	Attribute	In case of power off	Name	Data type	Description	Response
1	R		Revision	UINT	Object revision	0001H
2	R		Max Instance	UINT	The largest instance No.	0001H
3	R		Number of Instances	UINT	Number of instances of the generated object	0001H
6	R		Maximum ID Number Class Attributes	UINT	The largest attribute ID of class attribute	0007H
7	R		Maximum ID Number Instance Attributes	UINT	The largest attribute ID of instance attribute	0007H

■ Instance

● Instance service

Get_Attribute_Single (0EH), Get_Attributes_All (01H), and Reset service (05H) are supported.
For Reset service, see "Reset service", page 4-142.

● Instance attribute (instance ID: 1)

Attribute ID	Access	in case of power off	Name	Data type	Description	Response
1	Get		Vendor ID	UINT	Vendor identification No.	016FH
2	Get		Device Type	UINT	General device type	000CH
3	Get		Product Code	UINT	Product identification code	0064H:KV-5500 0065H:KV-EP21V 0069H:KV-NC1EP
4	Get		Revision	Structure	Identity object revision	----
			Major Revision	USINT	Major revision	01H
			Minor Revision	USINT	Minor revision	01H
5	Get		Status	WORD	EtherNet/IP Unit status	Data 1
6	Get		Serial Number	UDINT	Serial No.	Serial No.
7	Get		Product Name	SHORT-STRING	Product name	KV-NC21V KV-5500 KV-NC1EP

Data 1 Status (16 bits) content

Bit	Name	Description
0	Owned	ON : It should be set to ON when the EtherNet/IP Unit is the target, and is connected to from the originator.
1	Reserved	Always OFF.
2	Configured	ON: set to ON for cases other than communication without unit setting.
3	Reserved	Always OFF.
4 to 7	Extended Device Status	Bit 4-7 are described below according to the EtherNet/IP Unit status. 0101(1) : MajorFault status 0010(2) : not the status in (1), and time out occurs on one or more connections with the EtherNet/IP Unit as the target (NS LED is blinking in red) 0011(3) : not the status in (1) and (2), the status of no connection * is available (NS LED is blinking in green) 0110(4) : not the status in (1), (2), and (3), data receive in RUN mode occurs on one or more connections * 0111: status other than (1) to (4) *Refers to the connection with the EtherNet/IP Unit as both originator and target.
8	Minor Recoverable Fault	Always OFF.
9	Minor Unrecoverable Fault	Always OFF.
10	Major Recoverable Fault	ON: It will be ON when recoverable unit error occurs. MS LED blinks in red.
11	Major Unrecoverable Fault	ON: It will be ON when unrecoverable unit error occurs. MS LED illuminates in red.
12 to 15	Reserved	Always OFF.

● Reset service

Reset service is one of the CIP standard services, which is used to realize (simulate) the same operation as that of power supply restart. If the EtherNet/IP Unit accepts this service, function stop, communication cut off, and re-read of setting can be executed. Reset service can be used as restart request to update the changed parameters (for example, IP address, Ethernet communication rate etc). Please specify InstanceID of Identity object to 1, then execute Reset service. It is unnecessary to specify AttributeID. (It will be ignored if AttributeID is specified.)

Point

- **CPU unit can execute Reset service in PROG mode.**
- **If Reset service is executed in RUN mode, CIP General Status 10H (Device State Conflict) will be returned.**
- **The data packet received during Reset processing may be discarded.**
- **Response to Reset service will be returned before the EtherNet/IP Unit starts reset processing.**
- **Reset service can also be executed from EtherNet/IP Setting of KV STUDIO.**

Service code	Service name	Service data (1 byte)
05H	Reset	00H: simulate power supply reset. * 01H: restore to the factory setting, simulate power supply reset. 02H or above: unavailable • When above 02H is set, CIP error code 03H (Invalid parameter value) will be returned.

* If service data is omitted, the operation is the same as that when 00H is specified.

Initialized Unit Editor Setting list when service data is set to 1

Setting	Default value	Supported object and attribute	
Communication rate	100/10Mbps automatic	Ethernet Link object	Interface Control
IP address setting method	Fixed IP address	TCP/IP Interface object	Configuration Control
IP address	192.168.0.10		Interface Configuration (Structure)
Subnet mask	255.255.255.0		
Default gateway	0.0.0.0		
DNS server	0.0.0.0		
TTL for multicast	1		TTL Value
Multicast transfer address specifying method	Auto assignment		Mcast Config (Structure)
Number of multicast addresses	256		
Leading multicast address	239.255.0.0		

Message Router Object (Class ID: 02H)

The object is used to manage the received messages.

■ Class

● Class service

Get_Attribute_Single (0EH) is supported.

● Class attribute (instance ID: 0)

Attribute ID	Attribute	In case of power off	Name	Data type	Description	Response
1	R		Revision	UINT	Object revision	0001H
2	R		Max Instance	UINT	The largest instance No.	0001H
3	R		Number of Instances	UINT	Number of instances of the generated object	0001H
6	R		Maximum ID Number Class Attributes	UINT	The largest attribute ID of class attribute	0007H
7	R		Maximum ID Number Instance Attributes	UINT	The largest attribute ID of instance attribute	0002H

■ Instance

● Instance service

Get_Attribute_Single (0EH) is supported.

● Instance attribute (instance ID: 1)

Attribute ID	Attribute	In case of power off	Name	Data type	Description	Response
1	R		Object_list	Structure	The list of supported objects	-
			Number	UINT	Number of classes supported in the class array	0007H
			Classes	Array of UINT type	Class ID list	Class ID*
2	R		Number Available	UINT	Maximum number of connections	0100H

* 0001H, 0002H, 0004H, 0006H, 00F5H, 00F6H, 0065H

Assembly Object (Class ID: 04H)

The object is used to access the devices assigned to the EtherNet/IP Unit tag setting. Access is available for cyclic (I/O) messages and explicit messages.

■ Class

● Class service

Get_Attribute_Single (0EH) is supported.

● Class attribute (instance ID: 0)

Attribute ID	Attribute	In case of power off	Name	Data type	Description	Response
1	R		Revision	UINT	Object revision	0002H

■ Instance

● Instance service

Get_Attribute_Single (0EH) is supported.

● Instance attribute (instance ID: 100 to 199)

It can be used when instance ID is used in the tag setting.

Instance ID: 100 to 199

Attribute ID	Access	In case of power off	Name	Data type	Description	Response
3*1	Get		Data	BYTE array	Data assigned to InstanceID	Tag setting data assigned to InstanceID*2
4	Get		Size	UINT	Number of bytes assigned to instance ID	Tag setting size assigned to instance ID (in byte)

*1 In case Get_Attribute_Single is executed to AttributeID 3, if tag setting is larger than 500 bytes, the response 1BH (Response Too Large) will be returned.

*2 When Get_Attribute_Single is used to read data, except top priority (each scanning) of the refresh priority, synchronism by instance ID (tag setting) can be guaranteed.

Reference Not applicable to Dynamic Assembly.

Connection Manager Object (Class ID: 06H)

The object is used for connection type communication. It can be used when connection is established for the EtherNet/IP Unit.

■ Class

● Class service/class attribute

There is no class service/class attribute.

■ Instance

● Instance service

Forward_Open (54H), Large_Forward_Open (5BH), and Forward_Close (4EH) are supported. For service details, see CIP specification.
When the services are used, the EtherNet/IP Unit returns error codes as follows.

Error code list when Forward_Open and Large_Forward_Open services are used

GeneralStatus	Additional Status	Description
01H (Connection failure)	0100H	The specified connection has been used. (Connection Serial Number, Vendor ID, Originator Serial Number exist in the same connection.)
	0103H	The specified trigger cannot be used.
	0106H	Multicast cyclic (I/O) messages cannot begin due to the following reasons. • The currently used connection is Point to Point. • The connection to be established is Point to Point. • The currently used size is different from the size to be established.
	0108H	• Connection in the direction of originator -> target is not Point to Point. • Connection parameter in the direction of target -> originator is Point to Point instead of Multicast.
	0109H	The size beyond that defined in tag setting in cyclic (I/O) messages is used.*1
	0111H	• Time out multiplier is more than 7. • RPI less than 500ms or more than 10s is specified. *2
	0114H	• Vendor ID is inconsistent. • Product code is inconsistent.
	0115H	Device type is inconsistent.
	0116H	Revision is inconsistent.

GeneralStatus	Additional Status	Description
	0315H	• Connection Size of network connection parameter of ForwardOpen is 0. • Connection Path of ForwardOpen does not contain valid segment. • Wrong Class ID is specified in Connection Path of ForwardOpen (cyclic (I/O) messages, other than 02 for Class3). • Number other than 1 is specified for the instance ID of Connection Path of ForwardOpen in Class3. • Cyclic (I/O) messages, tag selected using Connection Path of ForwardOpen does not exist. • Product intrinsic setting (data segment) exists. • In cyclic (I/O) messages, wrong Connection Point is specified in sender -> target direction of Connection Path of ForwardOpen. • In cyclic (I/O) messages, number other than 2 is specified for Connection Size of network connection parameter in originator -> target direction of ForwardOpen. • In cyclic (I/O) messages, wrong Connection Point is specified in originator -> target direction of Connection Path of ForwardOpen.
02H (Resource unavailable)	-	The number of connections used had reached the maximum value.
04H (Path segment error)	-	AttributeID is specified for Connection Manager.
05H (Path destination unknown)	-	InstanceID other than 1 is specified in Connection Manager.
13H (Not enough data)	-	The specified send data size is too small.
15H (Too much data)	-	The send data size is too large.

*1 Connection will be established when the size is less than the size defined in the tag setting. When such error occurs, AdditionalStatus will be added, and the data size of the tag defined for the 2nd AdditionalStatus will be stored.

*2 RPI is set with unit as 500ms. If the value that cannot be exactly divided by 500ms is set, the rounded up value will be set as RPI.

Error code list when Forward_Close service is used

GeneralStatus	Additional Status	Description
01H (Connection failure)	0107H	The specified connection has been closed.
04H (Path segment error)	-	AttributeID is specified for Connection Manager.
05H (Path destination unknown)	-	Number other than 1 is specified for InstanceID of Connection Manager.
13H(Not enough data)	-	Send data size is too small.

● Instance attribute

There is no instance attribute.

TCP/IP Interface Object (Class ID: F5H)

The object is used to provide to rules to set TCP/IP network interface. IP address or subnet mask, default gateway etc can be set.

■ Class

● Class service

Get_Attribute_Single (0EH) and Get_Attributes_All (01H) are supported.

● Class attribute (instance ID: 0)

Attribute ID	Attribute	In case of power off	Name	Data type	Description	Response
1	R		Revision	UINT	Object revision	0001H
2	R		Max Instance	UINT	The largest instance No.	0001H
3	R		Number of Instances	UINT	Number of instances of the generated object	0001H

■ Instance

● Instance service

- Get_Attribute_Single (0EH), Set_Attribute_Single (10H), and Get_Attributes_All (01H) are supported.
- For Set_Attribute_Single executed for writeable AttributeID, when internal processing of previous Set_Attribute_Single is not completed, General Status “0CH” (Object State Conflict) will be returned.
- Change result of writeable AttributeID will be updated in case of power supply restart, reset service execution, unit setting information update, or PROG->RUN switching. However, when IP address setting method is changed from BOOTP to fixed IP address using Configuration Control, or when IP address setting method is set to BOOTP, Interface Configuration change will not be updated at PROG->RUN switching.

● Instance attribute (instance ID: 1)

ID	Attribute	In case of power off	Name	Data type	Description	Response
1	R		Status	DWORD	Interface status	(Data 1)
2	R		Configuration Capability	DWORD	Interface capability flag	(Data 2)
3	R/W	Hold	Configuration Control	DWORD	Specify the method for the device to acquire default setting at the time of start	(Data 3)
4	R		Physical Link Object	Structure	Path link object on physical layer	-
			Path size	UINT	Path size	0002H
			Path	Padded EPATH	Segment of the link object on physical layer	20F62401H
5	R/W	Hold	Interface Configuration	Structure	TCP/IP network interface setting	---
		Hold	IP Address	UDINT	Device IP address (IP address) *1	Set value *2
		Hold	Network Mask	UDINT	Device network mask (subnet mask) *1	Set value *2
		Hold	Gateway Address	UDINT	Default gateway address (Default gateway) *1	Set value *2
		Hold	Name Server	UDINT	Primary name server (DNS server) *1	Set value *2
			Name Server 2	UDINT	Secondary name server (reserved)	0 (Fixed)
			Domain Name	STRING	Default domain name (reserved)	0 (Fixed)
6	R/W		Host Name	STRING	Host name (reserved)	0 (Fixed)
8	R/W	Hold	TTL Value	USINT	TTL value for multicast *1	Set value *2
9	R/W	Hold	Mcast Config	Structure	Multicast address setting	-
		Hold	Alloc Control	USINT	Multicast address setting function (Multicast address specifying method) *1	0: Auto assignment 1: Specify by user
		Hold	Reserved	USINT	Reserved	00H
		Hold	Num Mcast	UINT	Number of multicast addresses (Number of multicast addresses) *1	Auto assignment: 0020H Specify by user :Set value *2
		Hold	Mcast Start Addr	UDINT	Start multicast address (Start multicast address) *1*4	Auto assignment:*3 Specify by user :Set value *2

*1 The changed value is updated to Unit Editor.

*2 If wrong value is written, General Status 09H (Invalid Attribute Value) will be returned. For the Unit Editor setting, see "Unit Editor Setting", page 3-2.

*3 Start multicast address for auto assignment is calculated as 239.192.1.0 + (((host part of IP address - 1) & 03FFH) x 32).

*4 This is the address used by the EtherNet/IP Unit to send tag setting data to other scanners in multicast mode. For EtherNet/IP, it is recommened to specify the address within the range of 239.255.0.0 to 239.255.255.255.

Data 1) Status list

Bit	Name	Description
0 to 3	Interface Configuration Status	0: the status when IP address is not set (BOOTP start status). 1: the status when IP address is set. 2 or above: No response is returned to the EtherNet/IP Unit.
4	Mcast Pending	It is changed to 1 if TTL Value or Mcast Config is set. It will be cleared to 0 when restarted, reset service, PROG -> RUN after setting change.
5 to 31	Reserved	All OFF (fixed).

Data 2) Configuration Capability list

Bit	Name	Description
0	BOOTP Client	ON (Fixed)
1	DNS Client	ON (Fixed)
2	DHCP Client	OFF (Fixed)
3	DHCP-DNS Update	OFF (Fixed)
4	Configuration Settable	ON (Fixed)
5 to 31	Reserved	OFF (Fixed)

Data 3) Configuration Control list

Bit	Name	Description
0 to 3	Startup Configuration	Display/set "IP address setting method" in Unit Editor. 0: Fixed IP address 1:BOOTP 2-15: setup is unavailable. If they are set, General Status 09H (Bad attribute data value) will be returned.
4	DNS Enable	ON (fixed): If it is set, the operation of this bit will be ignored.
5 to 31	Reserved	All OFF (fixed).

Ethernet Link Object (Class ID: F6H)

The object is used to provide Ethernet status information.

■ Class

● Class service

Get_Attribute_Single (0EH) and Get_Attributes_All (01H) are supported.

● Class attribute (instance ID: 0)

Attribute ID	Attribute	Supply hold	Name	Data type	Description	Response
1	R		Revision	UINT	Object revision	0002H
2	R		Max Instance	UINT	The largest instance No.	0001H
3	R		Number of Instances	UINT	Number of instances of the generated object	0001H

■ Instance

● Instance service

- Get_Attribute_Single (0EH), Set_Attribute_Single (10H), and Get_Attributes_All (01H) are supported.
- For AttributeID 4 and 5, Get_and_Clear service (4CH) is supported. The same response as Get_Attribute_Single will be returned, at the same time, the specified attribute value clears to 0. With respect to Get_and_Clear service other than the specified attributeID 4, 5, reply with response 0EH (Attribute not settable).
- For Set_Attribute_Single executed for settable AttributeID, when internal processing of previous Set_Attribute_Singleis is not completed, General Status 0CH (Object State Conflict) will be returned.
- Settable AttributeID change is updated in case of power supply restart, reset service execution, update of unit setting information, or PROG->RUN.

● Instance attribute (instance ID: 1)

ID	Attribute	Supply hold	Name	Data type	Description	Response
1	R		Interface Speed	UDINT	Interface communication speed.	10, 100
2	R		Interface Flags	DWORD	Interface status flag.	(Data 1)
3	R		Physical Address	ARRAY of 6 USINTs	MAC address	Current value
4	R		Interface Counters	Structure		-
			In Octets	UDINT	Number of octets received via interface. Including unneeded multicast packets, and discarded packets counted by In Discards.	Current value
			In Ucast Packets	UDINT	Number of unicast packets received via interface. Excluding the discarded packet counted by In Discards.	Current value
			In NUcast Packets	UDINT	Number of non-unicast packets received via interface. Including unneeded multicast packets, excluding discarded packets counted by In Discards.	Current value
			In Discards	UDINT	Number of discarded packets after receiving via interface.	Current value
			In Errors	UDINT	Number of received packets with error. Not included in the in Discards.	current value
			In Unknown Protos	UDINT	Number of received packets with unknown protocol. (reserved)	0 (Fixed)
			Out Octets	UDINT	Number of octets sent via interface.	Current value
			Out Ucast Packets	UDINT	Number of unicast packets sent via interface.	Current value
			Out NUcast Packets	UDINT	Number of non-unicast packets sent via interface.	Current value
			Out Discards	UDINT	Number of sent packet discarded.	current value
			Out Errors	UDINT	Number of sent packet with error.	Current value
5	R		Media Counters	Structure	Unique medium counter.	---
			Alignment Errors	UDINT	Number of received frames whose length is not octet integer.	Current value
			FCS Errors	UDINT	Number of received frames not passing FCS check.	Current value
			Single Collisions	UDINT	Number of successfully sent frames for which collision occurs only once. (reserved)	0 (Fixed)
			Multiple Collisions	UDINT	Number of successfully sent frames for which collision occurs 2 times or more. (reserved)	0 (Fixed)
			SQE Test Errors	UDINT	Number of times SQE test error message. (reserved)	0 (Fixed)
			Deferred Transmissions	UDINT	Number of delayed frames for initial send attempt since media status is busy. (reserved)	0 (Fixed)
			Late Collisions	UDINT	For the packets sent, number of collisions detected during packet send after 512-bit time. (reserved)	0 (Fixed)
			Excessive Collisions	UDINT	Number of frames failed in sending due to too many collisions. (reserved)	0 (Fixed)
			MAC Transmit Errors	UDINT	Number of frames failed in sending due to internal MAC sublayer send error. (reserved)	0 (Fixed)

ID	Attribute	Supply hold	Name	Data type	Description	Response
			Carrier Sense Errors	UDINT	When trying to send frame, times that carrier sence conditions are not satisfied or times without assertion.	Current value
			Frame Too Long	UDINT	Number of received frames beyond maximum allowable frame size.	Current value
			MAC Receive Errors	UDINT	Number of frames failed to receive via interface due to internal MAC sublayer receive error. (reserved)	0 (Fix)
6*2	W	Hold	Interface Control	Structure as follow	The setting of following physical interface.	---
			Control Bits	WORD	Interface management bit (AutoNego, all specify as full duplex).	(Data 2)
			Forced Interface Speed	UINT	Forced operation speed of the interface (10Mbps fixed etc).	Set value *1

*1 Interface speed that can be set to Forced Interface Speed is as follows.
Auto-negotiation disabled (half duplex): 10Mbps fixed (set value: 10)
Auto-negotiation enabled: 100/10Mbps automatic (set value: 0)

*2 Not compliant with KV-NC1EP

Data 1) Interface Flags list

Bit	Name	Description
0	Link Status	OFF: non-active link/ON: active link
1	Half/FullDuplex	OFF: half duplex/ON: full duplex It is OFF if Link Status=0
2 to 4	Negotiation Status	0: auto-negotiation execution in progress 1: auto-negotiation and speed detection failure 2: auto-negotiation failure, speed detection success 3: negotiation to speed and duplex mode success 4: no attempt of auto-negotiation (communication setting is 10Mbps fixed)
5	Manual Setting Requires Speed	OFF: change update can be executed automatically ON: change update needs Reset service (fixed)
6	Local Hardware Fault	OFF (Fixed)
7 to 31	Reserved	OFF (Fixed)

Data 2) Control Bits list

Bit	Name	Description
0	Auto-negotiate	OFF: auto-negotiation is disabled (communication setting is 10Mbps fixed) ON: auto-negotiation is enabled (communication setting is 100/10Mbps automatic)
1	ForcedDuplex Mode	0 (Fixed)
2 to 15	Reserved	OFF (Fixed)

CIP General Status List

General Status list replied from EtherNet/IP Device specified by CIP.

Code	Status name	Description
00H	Success	Service is executed successfully.
01H	Connection failure	Connection is failed.
02H	Resource unavailable	Since Resource of object is insufficient, service cannot be executed.
03H	Invalid parameter value	The specified parameter value is invalid.
04H	Path segment error	Path is invalid.
05H	Path destination unknown	Service receiver in specified path is not found in target node.
06H	Partial transfer	Information required for the service is insufficient.
07H	Connection lost	Explicit messages connection is cut off.
08H	Service not supported	The requested service is not supported .
09H	Invalid attribute value	The value specified for attribute is invalid.
0AH	Attribute list error	The attribute list specified by Get_Attribute_List or Set_Attribute_List service contains attribute that can not be set or acquired.
0BH	Already in requested mode/ state	The object is already in specified mode/status
0CH	Object state conflict	The object cannot execute the requested service in current status.
0DH	Object already exists	Specified instance already exists
0EH	Attribute not settable	The specified attribute value is read only.
0FH	Privilege violation	No authority to execute this service.
10H	Device state conflict	The object node cannot execute the requested service in current mode.
11H	Reply data too large	The response data size is too large.
12H	Fragmentation of a primitive value	The service can not divide the value of basic data type.
13H	Not enough data	Service data size is too small.
14H	Attribute not supported	The specified attribute is not supported
15H	Too much data	Since service data size is too large, the service cannot be executed.
16H	Object does not exist	The specified object does not exist.
17H	Service fragmentation sequence not in progress	Object node cannot receive message fragment correctly.
18H	No stored attribute data	No data is set to the specified attribute.
19H	Store operation failure	Error occurs when object node saves the attribute data.
1AH	Routing failure, request packet too large	The request message size is too large, therefore, data send to the object node in current network is unavailable.
1BH	Routing failure, response packet too large	Since response information is too large, it could not be received from the object node in current network.
1CH	Missing attribute list entry data	The specified attribute list does not include the attribute required for the service.
1DH	Invalid attribute value list	Invalid attribute exists in the specified attribute list.
1EH	Embedded service error	Error occurs in embedded service.
1FH	Vendor specific error	Vendor intrinsic error occurs on the object node.

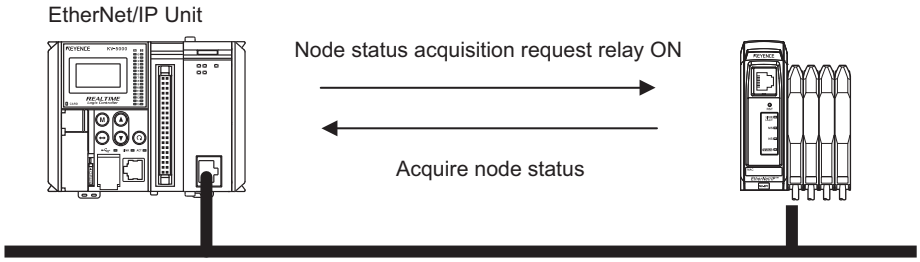
Code	Status name	Description
20H	Invalid parameter	The specified parameter is invalid.
21H	Write-once value or medium already written	Object node can not execute writing for the set value.
22H	Invalid Reply Received	Invalid response message is received.
23H	Buffer Overflow	Since response message size exceeds the size of receive buffer memory, data can not be received.
24H	Message Format Error	Message format is not supported.
25H	Key Failure in path	The specified electronic key is inconsistent with the object node.
26H	Path Size Invalid	The requested path size is too small or the path is too long, therefore, message cannot be routed.
27H	Unexpected attribute in list	The specified attribute is not in status to set value.
28H	Invalid Member ID	The specified member does not exist.
29H	Member not settable	The specified member is read only.
2AH	Group 2 only server general failure	Group 2 Only server cannot execute the specified service.
2BH	Unknown Modbus Error	Error occurs on the protocol conversion from CIP to Modbus.
2CH	Attribute not gettable	The specified attribute is unreadable.
D0 to FFH	Reserved for Object Class and service errors	Error specific to the adapter unit.

4-6 Node Status Acquisition Function

This section describes the node status acquisition function for checking the operation state of the EtherNet/IP Device (node) connected to the EtherNet/IP Unit, and how to use this function.

Overview

After specifying node address assigned to the EtherNet/IP Device (adapter or scanner) registered in the scan list of cyclic (I/O) messages, and setting node status acquisition request relay to ON, operation status and error status of the specified EtherNet/IP Device can be read.



Point

If node status acquisition request relay is ON, the IP address of EtherNet/IP Device, to which the specified node address is assigned, is used to execute explicit message, so as to read Status Attribute (AttributeID = 5) of Identity object. The read result is stored in the buffer memory.

Unit Editor Setting Related with Node Status Acquisition Function

Unit Editor setting of KV STUDIO related with node status acquisition function.
For other setting items in “Basic” of the Unit Editor, please set to appropriate value as required.
"Setting Item List", page 3-4

Unit Editor setting

Item	Setting range	Default value	See page
"Basic"			
Leading DM No.	0 to 65304 (0 to 32538 for KV-NC1EP)	To be set	3-6
Leading relay No. (ch unit setting)	10 to 960 (10 to 560 for KV-NC1EP)	To be set	3-6
Baud rate	"100/10Mbps automatic"/"10Mbps"	100/10Mbps automatic	3-6
Setting method of IP address	Fixed IP address/BOOTP/Fixed IP auto switching/BOOTP	Fixed IP address	3-6
IP address	(0 to 255).(0 to 255).(0 to 255).(0 to 255)	192.168.0.10	3-7
Subnet mask	(0 to 255).(0 to 255).(0 to 255).(0 to 255)	255.255.255.0	3-7
EtherNet/IP Setting			
Explicit messages time out (ms) *	10 to 65530	10000	3-12

* To setup the time out value of explicit messages to be executed when executing node address acquisition function.

Device Used in Node Status Acquisition Function

■ Relay

n: Leading relay No.

Relay No.	Name	Function	R/W
n+702	Node status capture req	OFF->ON: execute node status acquisition. • During node status acquisition, next node status acquisition request is not accepted.	W
n+1702	Node status capture end	ON: it is ON after node status acquisition is completed. ON->OFF: it is OFF when node status acquisition request relay is OFF.	R
n+1703	Node status capture fail	ON: both it and the complete relay are ON if node status acquisition fails. ON->OFF: it is OFF when node status acquisition request relay is OFF.	R

■ Buffer memory

Buffer memory address	Name	Function	R/W
#1580 to 1595	Scan List RegistNode tbl*1	ON: node registered in scan list is ON. • The node reserved for EtherNet/IP Device will not be ON.	R
#2800	Get node status Node address	Store node address to acquire status. The setting range is 1 to 256. • Error occurs during operation if the store value is out of the setting range.	W
#2801	Get node status end code	Store complete code.	R
#2802	Get node status Detail end code	Store detailed complete code.	R
#2803	Get node status Node status	Store EtherNet/IP Device status.	R

*1 In 16-word (256 bits) area, each node occupies 1 bit from node 1. For node table and assignment of node address, see "Node table and assignment of node address", page 4-65.

● Node status acquisition node status

The result after reading Status Attribute (AttributeID=5) of Identity object of EtherNet/IP Device is stored in the node status acquisition node status.
For status detail of EtherNet/IP Devices, see appropriate unit manuals.

Status (AttributeID=5) content of General EtherNet/IP Device

Bit	Name	Description
0	Owned	It is ON when owner exists in EtherNet/IP Device.
1	Reserved	Always OFF.
2	Configured	It is ON when EtherNet/IP Device is not in factory setting.
3	Reserved	Always OFF.
4 to 7	Extended Device Status	The area of detailed EtherNet/IP Device status. Divided into vendor intrinsic status and the status specified by CIP.
8	Minor Recoverable Fault	The area to store error information of EtherNet/IP Device. Error content varies with vendors. Recoverable Fault : Recoverable errors. Unrecoverable Fault : Unrecoverable errors.
9	Minor Unrecoverable Fault	
10	Major Recoverable Fault	
11	Major Unrecoverable Fault	
12 to 15	Reserved	Always OFF.

● Node status acquisition complete code/node status acquisition detailed complete code

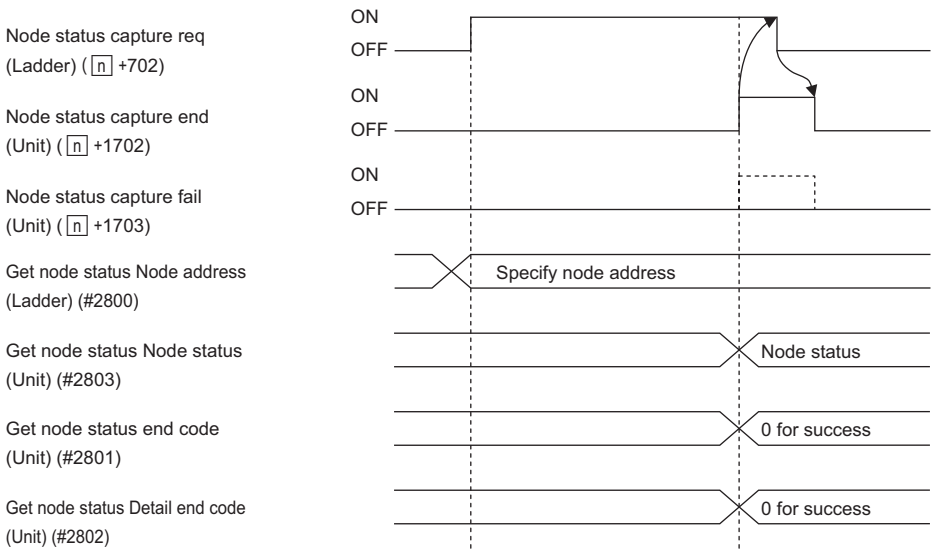
Reference When problems could not be solved based on causes and measures, or confirmation method is indefinite, see the troubleshooting No. description. "Troubleshooting", page A-16

Completed Code (Decimal)	Detailed Completed Code (Decimal)	Description	Causes and measures	Troubleshooting No.
0	0	OK	-	-
1 to 255	0 to 65535	CIP error	Return General Status specified by CIP from EtherNet/IP Device of the communication object. "CIP General Status List", page 4-153	100
10500	0	Explicit messages time out error	Explicit messages time out occurs. • Please check power supply, and cable status of the units on communication line, such as target unit or Ethernet switch etc. • Please check Ethernet link status to be 100Mbps, full duplex via Unit Monitor. • Please check whether unexpected network load exists.	102
10501	0	Processing interrupt error	Since either Ladder program transfer or Reset service is executed, the processing is interrupted.	103
10502	0	Processing interrupt error	Since either Ladder program transfer or Reset service is executed, the processing is interrupted.	103

Completed Code (Decimal)	Detailed Completed Code (Decimal)	Description	Causes and measures	Troubleshooting No.
10504	0	Incorrect node address error	The specified node address cannot be used in the executed function. Please check whether the specified node address can be used via EtherNet/IP Setting.	105
10507	0	IP address not set error	Since IP address is not set, the function cannot be executed. • Please set IP address.	129

Steps and Reference Program of Node Status Acquisition Function

■ Steps of node status acquisition function



(1) Store the node address to acquire status in the Get node status Node address *.

(2) Set Node status capture req relay to ON.

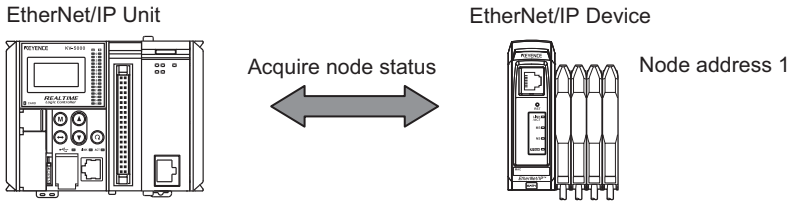
(3) When node status acquisition is completed, Get node status end code (store 0 in case of success) *, and Get node status Detail end code* are stored in the buffer memory, Node status capture end relay ON.
If Node status capture fail relay is ON, read Get node status end code *, and process with the error.

(4) Check Node status capture end relay to be ON, then set Node status capture req relay to OFF. When KV-EP21V detects Node status capture req relay is OFF, Node status capture end relay will be OFF.

*1 If unit-specific command is used, program is available without using buffer memory address.
"Unit-specific Command for Node Status Acquisition Function", page 4-161

■ Reference program of node status acquisition function

The following describes the sample program for executing node status acquisition between EtherNet/IP Units and EtherNet/IP Devices.



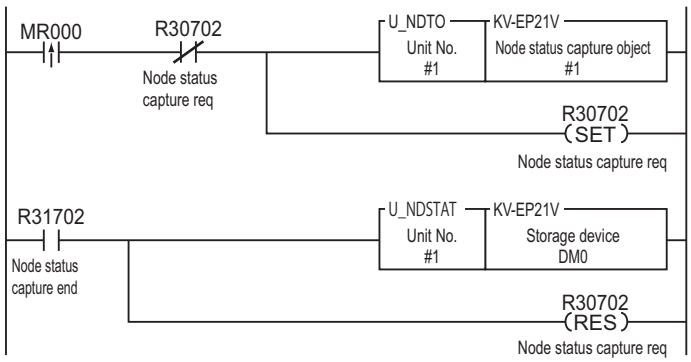
Unit Editor Setting

Setting item	Description
Leading DM No.	DM10000
Leading relay No.	R30000

Storage area of the data used in the sample program

DM0	Node status acquisition complete code
DM1	Node status acquisition detailed complete code
DM2	Node status acquisition node status

Example) acquire node status of EtherNet/IP Device of node address 1.



<Mnemonic list>

```
LDP MR000
ANB R30702
U_NDTO #1 #1
SET R30702
LD R31702
U_NDSTAT #1 DM0
RES R30702
```

Unit-specific Command for Node Status Acquisition Function

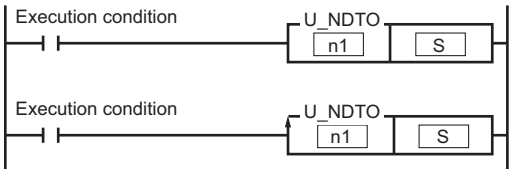
■ Unit-specific command list for node status acquisition function

Function	Command	Operation	Page
Specify node status acquisition object	U_NDTO	Write object node address to acquire node status in the buffer memory.	4-162
Read node status acquisition result	U_NDSTAT	Read node status acquisition result from the buffer memory.	4-164
Read register node table	U_SLREG	Read register node table of the scan list from the buffer memory.	4-166

U_NDTO / @U_NDTO

U_NDTO	U_NDTO(.U)	U_NDTO	Specify node status acquisition object
@U_NDTO	@U_NDTO(.U)	U_NDTO	Specify node address to acquire node status.

Ladder program



Input method

U _ N D T O ␣ n1 ␣ S ↵

@ U _ N D T O ␣ n1 ␣ S ↵

Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
S	○	-	○	-	-	-	○	○	○*2	○	○	-	-	-	○	○	-	-	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
S	Specify node address or its storage device. *1

*1 If bit device is specified, consecutive 16 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

*2 EM, FM and ZF cannot be used with the KV Nano Series.

Operation Description

U_NDTO If execution condition is ON, write the node address stored in S to the buffer memory of No. n1 unit.

	Device No.	Buffer memory address
Node status acquisition object node address	S	#2800

@U_NDTO Only one scan is executed at the rising edge of execution condition.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON if any of the following conditions are met, otherwise it is OFF. • The unit No. specified by n1 is out of range. • The unit with the unit No. specified with n1 is not KV-EP21V, KV-5500 or KV-NC1EP. • The range of indirect specifying and index modification is inappropriate

* If the CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

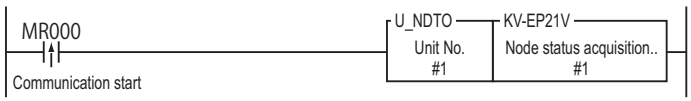
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

Sample Program

At the rising edge of MR000, write node address 1 in the buffer memory.

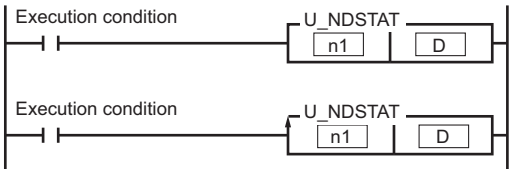


<Mnemonic list>

```
LDP MR000
U_NDTO #1 #1
```

U_NDSTAT	**U_NDSTAT(.U)** 	Read node status acquisition result	Read node status acquisition result from the buffer memory.
@U_NDSTAT	**@U_NDSTAT(.U)** 		

Ladder program



Input method





Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
D	○	-	○	-	-	-	○	○	○*3	○	○	-	-	-	○	-	-	-	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
D	Specify the leading device to store the acquisition result. *1*2

*1 If bit device is specified, consecutive 48 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 48 bits will be processed by crossing over to the next channel.

*2 If word device is specified, consecutive 3 words will be processed.

*3 EM, FM and ZF cannot be used with the KV Nano Series.

Operation Description

U_NDSTAT If execution condition is ON, read node status acquisition result of No. n1 unit, and store it in 3-word devices with D as leading device.

Acquisition result	Buffer memory address	Device No.
Node status acquisition complete code	#2801	D + 0
Node status acquisition detailed complete code	#2802	D + 1
Node status acquisition node status	#2803	D + 2

@U_NDSTAT Only one scan is executed at the rising edge of execution condition.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON if any of the following conditions are met, otherwise it is OFF. • The unit No. specified by n1 is out of range. • The unit with the unit No. specified with n1 is not KV-EP21V, KV-5500 or KV-NC1EP. • 3-word devices from the device specified by D cannot be ensured • The range of indirect specifying and index modification is inappropriate

* If the CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

Sample Program

When node status acquisition is completed, store the acquisition result in DM0 to DM2.



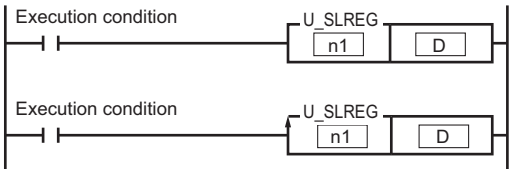
<Mnemonic list>

```
LDP R31702
U_NDSTAT #1 DM0
```

U_SLREG / @U_SLREG

U_SLREG	U_SLREG(.U)	U_SLREG	Read register node table	Read register node table of the scan list from the buffer memory.
@U_SLREG	@U_SLREG(.U)	U_SLREG		

Ladder program



Input method

U_SLREG n1 D ↵

@U_SLREG n1 D ↵

Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
D	○	-	○	-	-	-	○	○	○*3	○	○	-	-	-	○	-	-	-	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
D	Specify the device to store read scan list register node table. *1*2

*1 If bit device is specified, consecutive 256 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 256 bits will be processed by crossing over to the next channel.

*2 If word device is specified, consecutive 16 words will be processed.

*3 EM, FM and ZF cannot be used with the KV Nano Series.

Operation description

U_SLREG If execution condition is ON, read scan list register node table from No. n1 unit, and store it in D.

	Buffer memory address		Device No.
Scan list registered node table	#1580 to #1595	→	D + 0 to D + 15

"Node table and assignment of node address", page 4-65

@U_SLREG Only one scan is executed at the rising edge of execution condition.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON if any of the following conditions is met, otherwise it is OFF. • The unit No. specified by n1 is out of range. • The unit with the unit No. specified with n1 is not KV-EP21V, KV-5500 or KV-NC1EP. • Consecutive 16-word devices from device No. specified by D cannot be ensured. • The range of indirect specifying and index modification are inappropriate.

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

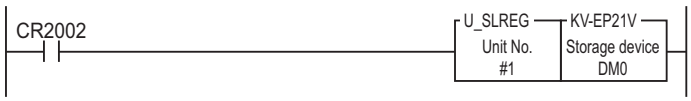
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

Sample Program

Always read scan list register node table from the buffer memory, and store it in DM0 to D15 (16 words).



<Mnemonic list>

```
LD CR2002
U_SLREG #1 DM0
```

Unit-specific Function for Node Status Acquisition Function

■ Unit-specific function list for node status acquisition function

Function	Function	Operation	Page
Specify node status acquisition object	U_NDTO	Write object node address to acquire node status in the buffer memory.	4-169
Read node status acquisition result	U_NDSTAT	Read node status acquisition result from the buffer memory.	4-170
Read scan list register node table	U_SLREG	Read register node table of the scan list from the buffer memory.	4-171

U_NDTO Specify node status acquisition object

U_NDTO ([execution condition]*1, unit No., node status acquisidt)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No. *2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	-
S	Node status acquisition object *3*4*5	Specify the node address or the device No. to store the node address.	.U	.U	.U	.U	-	-	-	-	○	○	-

*1 [ ] can be omitted. (If execution condition is omitted, function is executed in each scanning.)
*2 $ (specify hex) cannot be used.
*3 CTC, CTH, and Z cannot be specified.
*4 If bit device is specified for S, consecutive 16 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.
*5 If word device is specified for S, consecutive 1 word will be processed.

Operation Description

U_NDTO If execution condition is ON, write the node address stored in S to the buffer memory of No. n unit.

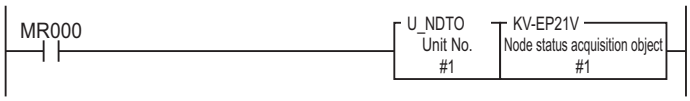
	Device No.	Buffer memory address
Node status acquisition object node address	S	#2800

● Format example

Script programming U_NDTO(MR0,1,1)

Operation description When MR000 is ON, write node address 1 in the buffer memory.

Ladder conversion



U_NDSTAT Read node status acquisition result

U_NDSTAT ([execution condition]*1, unit No., storage target device No.)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No. *2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	-
D	Storage device No. *3*4*5	Specify the leading device No. to store the acquisition result.	.U	.U	.U	.U	-	-	-	-	-	○	-

*1 [ ] can be omitted. (If execution condition is omitted, function is executed in each scanning.)
*2 $ (specify hex) cannot be used.
*3 CTC, CTH, and Z cannot be specified.
*4 If bit device is specified for D, consecutive 48 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 48 bits will be processed by crossing over to the next channel.
*5 If word device is specified for D, consecutive 3 words will be processed.

Operation Description

U_NDSTAT If execution condition is ON, read node status acquisition result of No. n unit, and store it in 3-word devices with D as leading device.

Acquisition result	Buffer memory address	Device No.
Node status acquisition complete code	#2801	D + 0
Node status acquisition detailed complete code	#2802	D + 1
Node status acquisition node status	#2803	D + 2

● Format example

Script programming U_NDSTAT(MR0,1,DM0)

Operation description When MR000 is ON, store the node status acquisition result in DM0 to DM2.

Ladder conversion



U_SLREG Read scan list register node table

U_SLREG ([execution condition]*1, unit No., storage target device No.)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No. *2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	○
D	Storage device No. *3*4*5	Specify the leading device to store read scan list register node table.	.U	.U	.U	.U	-	-	-	-	-	○	-

*1 [ ] can be omitted. (If execution condition is omitted, function is executed in each scanning.)
*2 $ (specify hex) cannot be used.
*3 CTC, CTH, and Z cannot be specified.
*4 If bit device is specified for D, consecutive 256 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 256 bits will be processed by crossing over to the next channel.
*5 If word device is specified for D, consecutive 16 words will be processed.

Operation Description

U_SLREG If execution condition is ON, read scan list register node table from No. n unit, store in 16 words started from D.

	Buffer memory address		Device No.
Scan list register node table	#1580 to #1595	⇒	D + 0 to D + 15

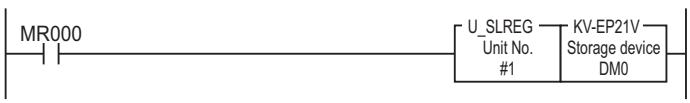
"Node table and assignment of node address", page 4-65

- **Format example**

Script programming U_SLREG(MR0,1,DM0)

Operation description When MR000 is ON, read scan list register node table connected to the first unit, and store it in DM0 to DM15.

Ladder conversion



Data Type and Device Storage Mode

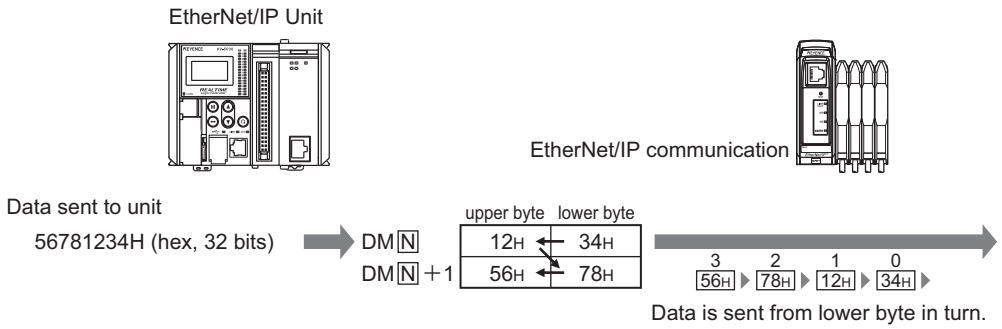
The following describes the data type and device storage mode of CPU unit when EtherNet/IP communication function is used.

● Data type (other than CIP character string type data) and the storage mode

Device storage mode when data type other than CIP character string type data is used is described.

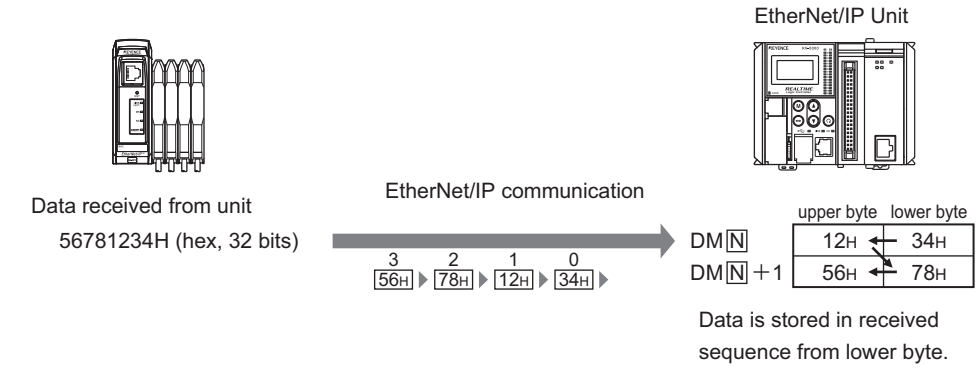
Data send (EtherNet/IP Unit->unit)

The data stored in device are sent from lower byte.



Data receive (unit->EtherNet/IP Unit)

Data is stored in the device from lower byte in turn.



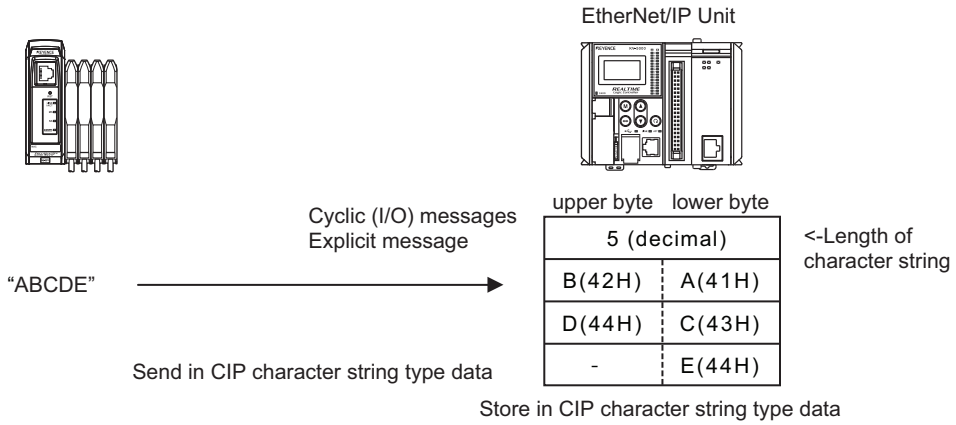
Point

- **When 1--byte data type (BYTE, BOOL, USINT, SINT) is used to read unit data, data are stored in lower bytes, and 0 is stored in upper bytes. For unit data write, only lower bytes are used, while upper bytes are not used.**
- **Device storage mode of sensor application function is universal to the device storage mode of cyclic (I/O) messages and explicit messages functions.**

■ CIP character string type data and storage mode

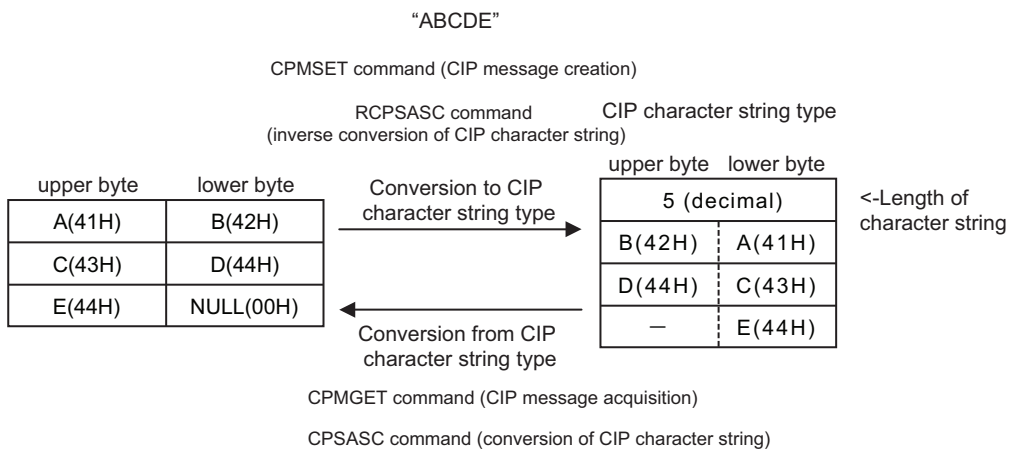
For CIP character string type data, the character string data length is stored in the 2-byte (1 word) leading device, and the character string is stored from lower bytes in turn.

Example) when ASCII character string "ABCDE" is sent from the unit in the format of CIP character string type data, it is stored in the devices of KV-EP21V for cyclic (I/O) messages function and explicit messages function as follows.



Reference

If CPMSET command (CIP message creation) is used, conversion from CIP character string type data during data receive and conversion to CIP character string type data during data send can be executed with commands.
Example) conversion and inverse conversion of CIP character string type data "ABCDE"



- CPMSET command (CIP message creation), page 4-175
- CPMGET command (CIP message acquisition), page 4-180
- RCPSASC command (Inverse conversion of CIP character string type data), page 4-184
- CPSASC command (Conversion of CIP character string type data), page 4-186

Command Related with CIP Data

■ Command list related with CIP messages

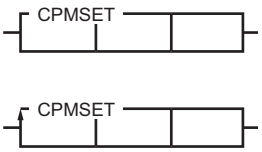
Function	Command	Operation	Page
CIP message creation	CPMSET	Create the data to be sent in CIP explicit messages.	4-175
CIP message acquisition	CPMGET	Acquire character string data and numerical data from the data received in CIP explicit messages.	4-180

■ Command list related with CIP character string type data

Function	Command	Operation	Page
Inverse conversion of CIP character string type data	RCPSASC	Convert character string data to CIP character string type data.	4-184
Conversion of CIP character string type data	CPSASC	Convert CIP character string type data to character string data.	4-186

CPMSET

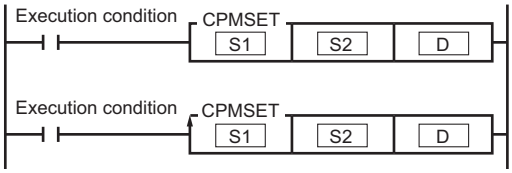
@CPMSET



CIP message creation

Create the data to be sent in CIP explicit messages.

Ladder program



Input method

C P M S E T ␣ S1 ␣ S2 ␣ D ↵

@ C P M S E T ␣ S1 ␣ S2 ␣ D ↵

Operand	Available device																		Index modification
	Bit device							Word device							Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
S1	○	-	○	-	-	-	○	○	○*3	-	-	-	-	-	○	-	-	○	○	○
S2	○	-	○	-	-	-	○	○	○*3	○	○	○	○	○	○	○	-	○	○	○
D	○	-	○	-	-	-	○	○	○*3	-	-	-	-	-	○	-	-	○	○	○

Operand	Description
S1	Specify the leading device to add send data. *1
S2	Specify data type and data size (in byte) of the send data to be added or its storage device. *2
D	Specify the leading device to create send data. *1

*1 If bit device is specified, please specify the leading device of the channel.

*2 If bit device is specified, consecutive 16 bits will be processed. Specify any relay (R002, R1012 etc) other than the leading one of the channel, 16 bits will be processed by crossing over to the next channel.

*3 EM, FM and ZF cannot be used with the KV Nano Series.

Point

The command can be used in function version 2 or above CPU units and base units.

Operation Description

CPMSET

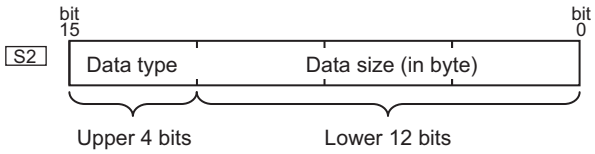
If execution condition is ON, add the data stored on the S1 to the area from behind the data size (byte) stored to the D + 0 by using the data type specified by the upper 4 bits of the S2 and the data size (bit) of the lower 12 bits of the S2.

After data is added, the data size in D + 0 will be updated.

When adding data for the first time, 0 is stored in D + 0, then the command is executed.

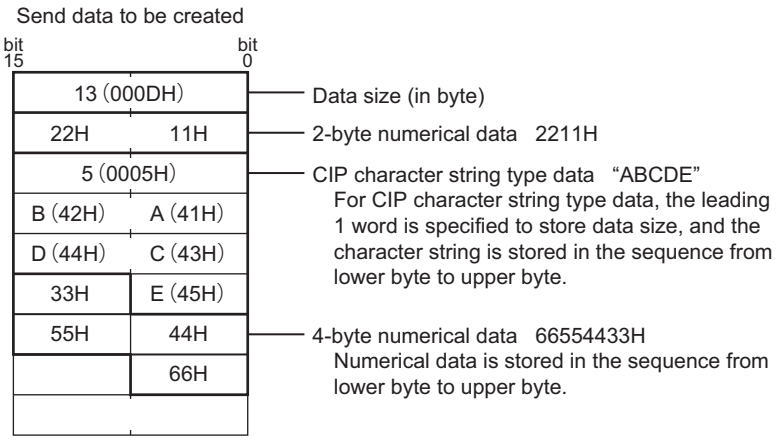
CPMSET command is used to create CIP character string type data, and numerical data.

For CIP data type, see "Data Type and Device Storage Mode", page 4-172.



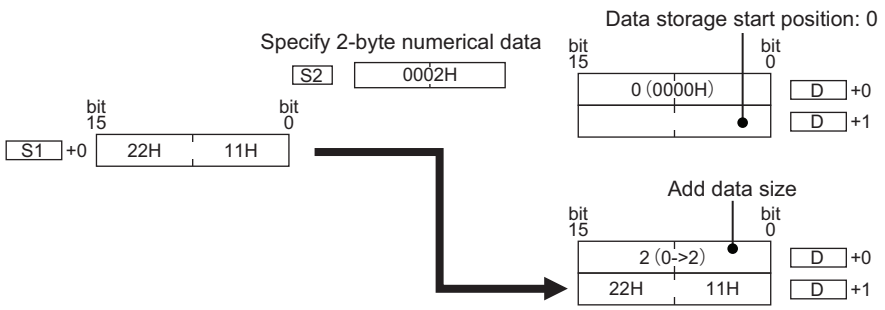
Upper 4 bits	lower 12 bits
0: non character string	1-4095 (001H-FFFH): specify data size
1: Character string	0-1999 (000H-7CFH): specify number of characters for conversion to CIP character string type data If 0 is specified, characters before NULL (00H) are converted. If the specified number of characters contains NULL (00H), 00H will be added after NULL (00H).
2 or above: reserved for system	-

Example **The following takes creating send data in CIP data type as example to describe the operation of CPMSET command.**



Example 1) store leading 2-byte numerical data.

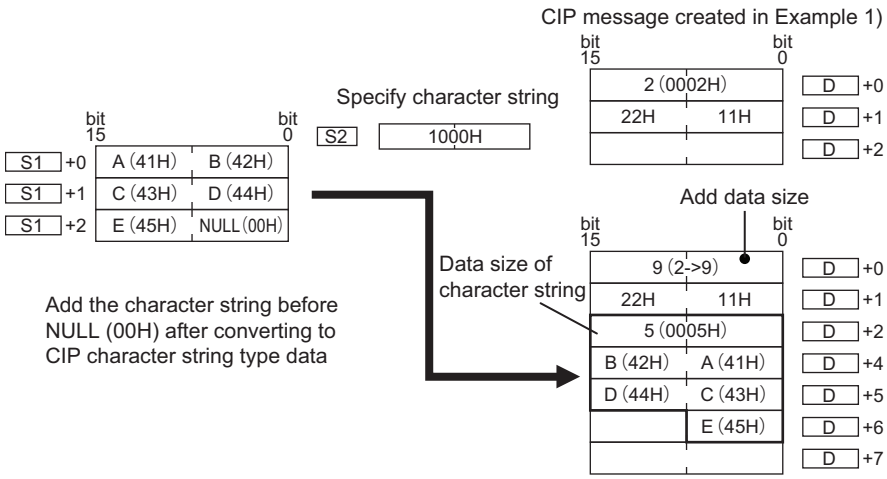
Firstly store 0 in D + 0, specify 0002H (2 byte part out of the character string) in S2, then execute CPMSET command. If 0 is stored in D + 0, numerical data is stored in devices after D + 1, and the stored data size (in byte) is added to D +0.



Example 2) convert character string "ABCDE" to CIP character string type data, then add it. Here, add it after the 2-byte numerical data in Example 1).

Specify 1000H (character string)* in S2, and execute CPMSET command. Convert the character string specified after S1 to CIP character string type data, and add it to the end of CIP message specified by D and created in example 1). The added data size (in byte) is added to D +0.

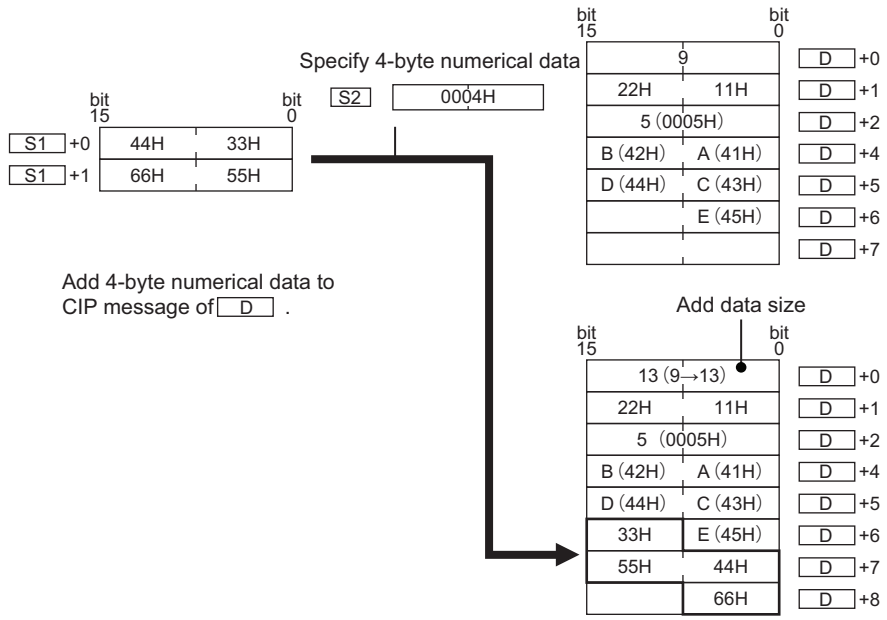
* If 0 is specified for the lower 12 bits of S2, the character string before NULL (00H) will be converted.



Example 3) store 4-byte numerical data. Here, add it behind the character string data in Example 2).

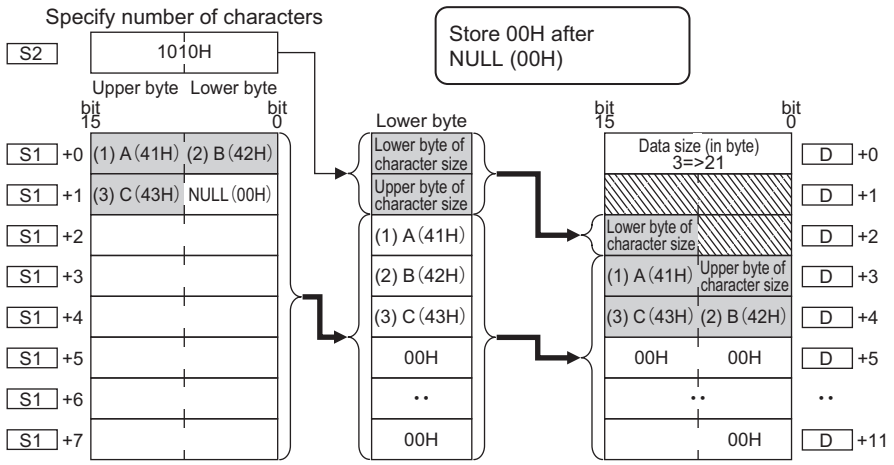
Specify 0004H (4 bytes for non character string) in S2, and execute CPMSET command.

Add numerical data behind the CIP messages specified by D and created in Example 2). The added data size (in byte) is added to D +0.



Point

If 1 (character string) is specified in upper 4 bits of [S2], when 1-1999 is specified in lower 12 bits of [S2], the character string in specified number of bytes will be stored. If NULL (00H) is included midway, 00H will be added to the characters behind NULL (00H). The specified number of characters will be added to [D] + 0.



@CPMSET Only one scan is executed at the rising edge of execution condition.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON when any of the following conditions is satisfied, otherwise, it is OFF. • If bit device is specified for [S1] and [D], the device other than the leading device of the channel is specified • The upper 4 bits of [S2] are 1 (character string), character string length of [S1] is 0 or above 2000 • The upper 4 bits of [S2] are 1 (character string), there is no end character in [S1] • The upper 4 bits of [S2] are 1 (character string), the lower 12 bits of [S2] are above 2000 • The upper 4 bits of [S2] are 0 (non character string), the lower 12 bits of [S2] are 0 • The upper 4 bits of [S2] are above 2 • The data size exceeds 65535 after adding • The range of indirect specifying and index modification is inappropriate

* If the CR2012 is ON, command is not executed.

[KV-5500/5000/3000] If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

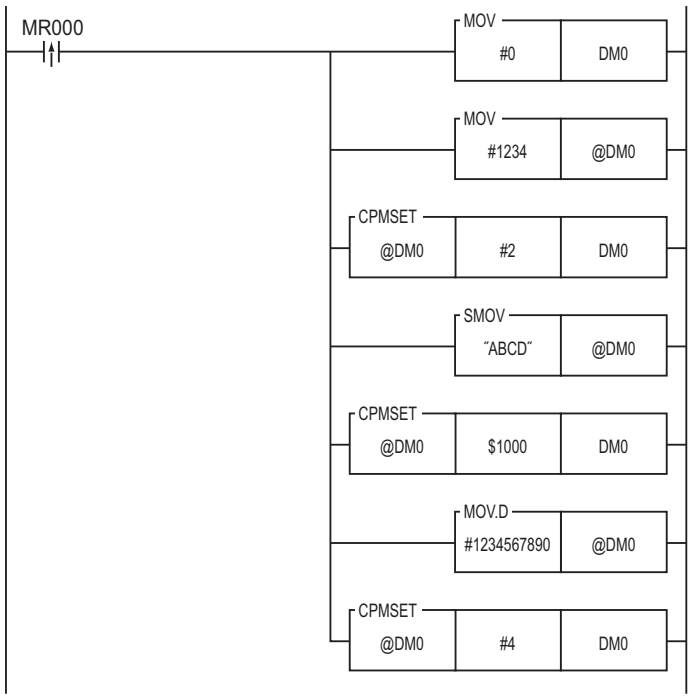
[KV Nano series] If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

Sample Program

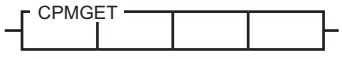
If input relay MR000 is ON, 16 bit unsigned BIN data (1234), character string (ABCD: 4 bytes), 32 bit unsigned BIN data (1234567890) are converted to CIP data type in turn, and stored in devices after DM1, the total number of data is stored in DM0.



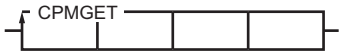
<Mnemonic list>

```
LDP MR000
MOV #0 DM0
MOV #1234 @DM0
CPMSET @DM0 #2 DM0
SMOV "ABCD" @DM0
CPMSET @DM0 $1000 DM0
MOV.D #1234567890 @DM0
CPMSET @DM0 #4 DM0
```

CPMGET



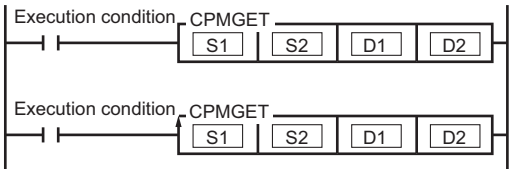
@CPMGET



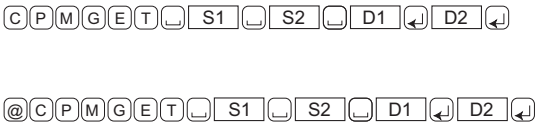
CIP messages acquisition

Acquire character string data and numerical data from the data received in CIP explicit messages.

Ladder program



Input method



Operand	Available device																		Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
S1	○	-	○	-	-	-	○	○	○*3	-	-	-	-	-	○	-	-	○	○	○
S2	○	-	○	-	-	-	○	○	○*3	○	○	○	○	○	○	○	-	○	○	○
D1	○	-	○	-	-	-	○	○	○*3	○	○	-	-	-	○	-	-	○	○	○
D2	○	-	○	-	-	-	○	○	○*3	-	-	-	-	-	○	-	-	○	○	○

Operand	Description
S1	Specify the leading device storing the received data in CIP data type. *1
S2	Specify data type and data size (in byte) of the data to be acquired or its storage device. *2
D1	Specify the device to store byte offset position from the leading devices of the received data to specify acquisition position. *1
D2	Specify the leading device of the devices to store the acquired data. *1

*1 If bit device is specified, please specify the leading device of the channel.

*2 If bit device is specified, consecutive 16 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

*3 EM, FM and ZF cannot be used with the KV Nano Series.

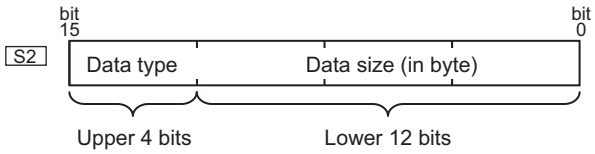
Point

The command can be used in CPU unit with function version 2 or above.

Operation Description

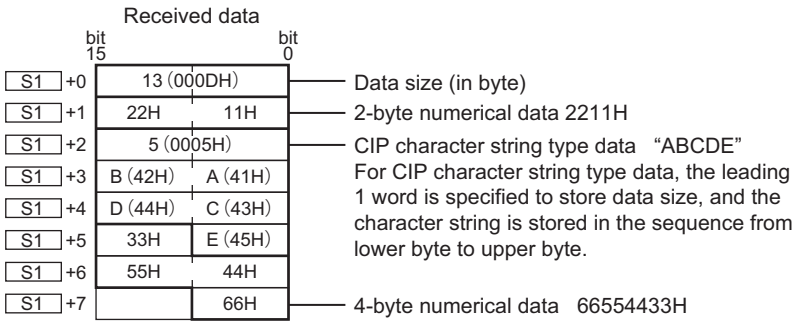
CPMGET

If execution condition is ON, store the data behind the byte offset position specified by the data of the D1 stored from behind the S1. Store the data size (bit unit) specified by the lower 12 bits of the S2 parameter into the D2 output data storage lead device by using the data type specified by the upper 4 bits of the S2 parameter. After the data is stored, the byte offset position of D1 is updated.
When receiving data from the leading device, store 0 in D1, then execute the command. Since byte offset position is updated, data can be acquired consecutively.
CPMGET command is used to read numerical value and character string in CIP data type received during CIP explicit messages etc.
For CIP data type, see "Data Type and Device Storage Mode", page 4-172.



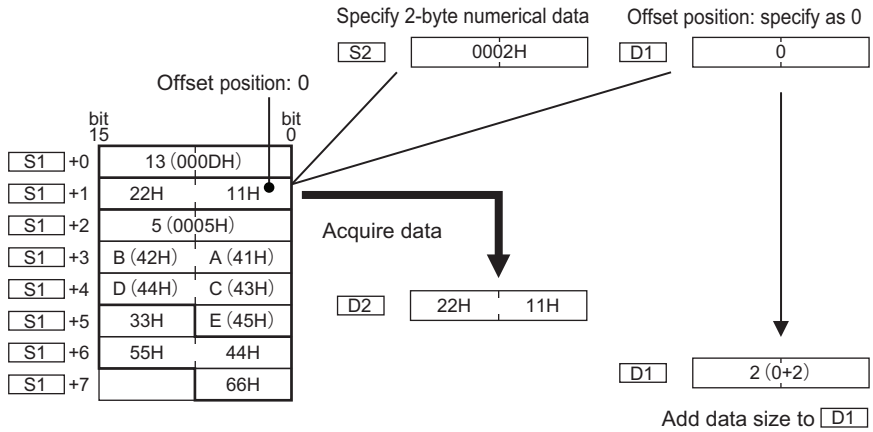
Upper 4 bits	lower 12 bits
0: non character string	1-4095 (001H-FFFH): specify data size
1: Character string	0-1999 (000H-7CFH): Specify the number of characters If 0 is specified or the value larger than the number of characters of the CIP character string type data is specified, the character string within the number of characters of CIP character string type data is stored. If a value less than the number of characters of CIP character string type data is specified, the character string of the specified number of characters will be stored.
2 or above: reserved for system	-

Example **The following takes received data as example to describe how to use CPMGET command.**



Example 1) read leading 2-byte numerical data.

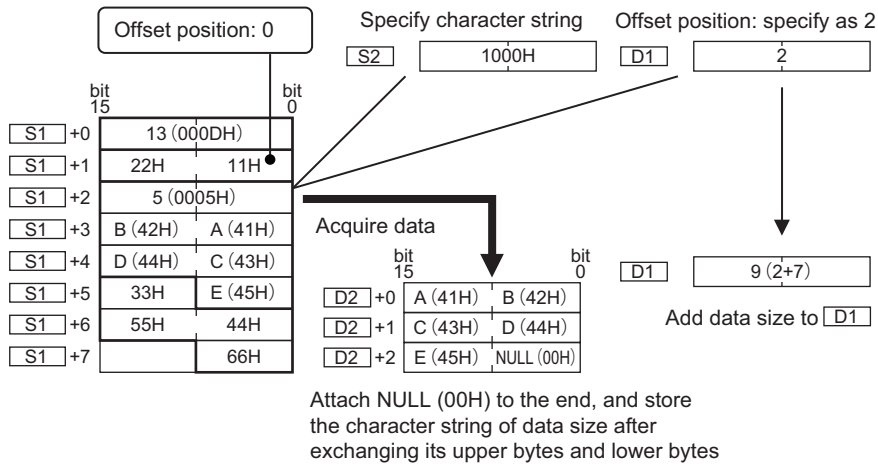
Specify 0 (offset position 0) in D1, specify 0002H (2 bytes for non character string) in S2, an execute CPMGET command.



Example 2) read CIP character string type data behind offset position 2.

Specify 2 (offset position 2) in D1, specify 1000H (character string) in S2, and execute CPMGET command.

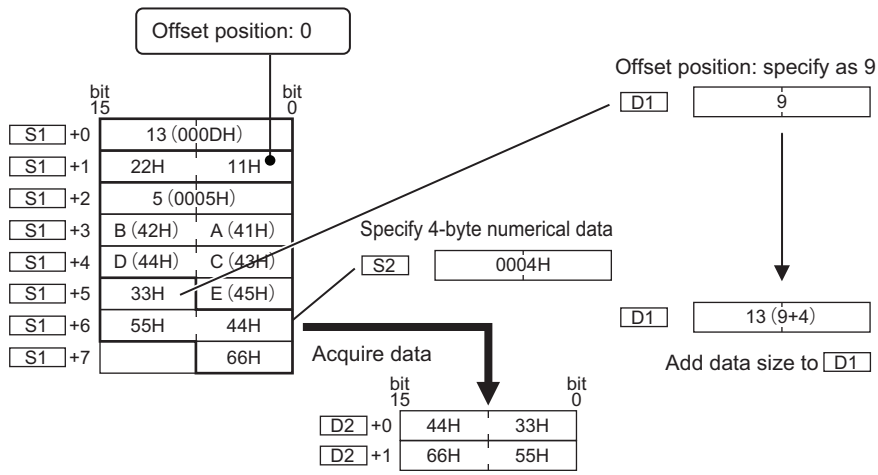
If 0 is specified in lower 12 bits of S2, the character string of data size specified by offset position will be read.



If the character string size of S1 is larger than the character size specified by the lower 12 bits of S2, character string with the character size specified by the lower 12 bits of S2 will be acquired. The character size specified by the lower 12 bits of S2 and 2 bytes will be added to D1.

Example 3) read 4-byte numerical data behind offset position 9.

Specify 9 (offset position 9) in D1, specify 0004H (4 bytes for non character string) in S2, and execute CPMGET command.



@CPMGET Only one scan is executed at the rising edge of execution condition.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON when any of the following conditions is satisfied, otherwise, it is OFF. • If bit device is specified for S1 and D2, the device other than the leading device of the channel is specified • The upper 4 bits of S2 are 1 (character string), the lower 12 bits are 0, character string with length above 2000 in S1 is specified • The upper 4 bits of S2 are 1 (character string), the lower 12 bits of S2 are above 2000 • The upper 4 bits of S2 are 0 (non character string), the lower 12 bits of S2 are 0 • The upper 4 bits of S2 are above 2 • Before executing, D1 exceeds data size specified by S1 + 0 • After executing, D1 exceeds data size specified by S1 + 0 • The range of indirect specifying and index modification is inappropriate

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

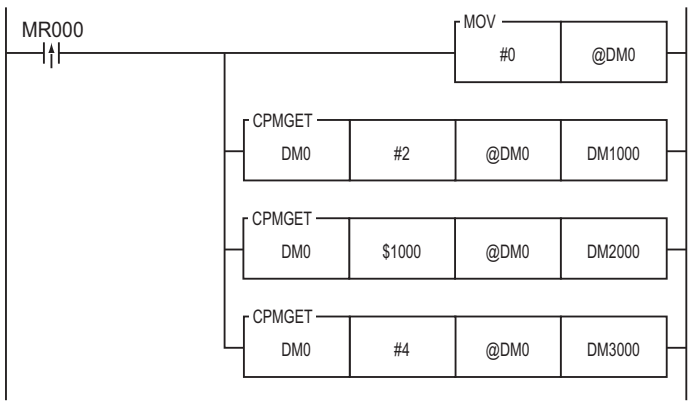
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

Sample Program

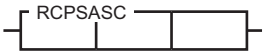
If input relay MR000 is ON, convert the data (in CIP data type) stored in devices with DM0 as leading device to 2-byte numerical data, character string data, and 4 byte numerical data in turn, and store it in DM1000, DM2000, and DM3000.



<Mnemonic list>

```
LDP MR000
MOV #0 @DM0
CPMGET DM0 #2 @DM0 DM1000
CPMGET DM0 $1000 @DM0 DM2000
CPMGET DM0 #4 @DM0 DM3000
```

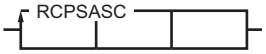
RCPSASC



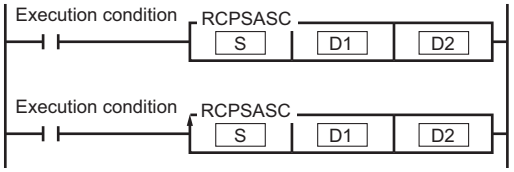
Inverse conversion of CIP character string type data

Convert character string data to CIP character string type data.

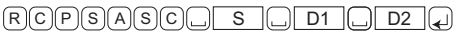
@RCPSASC



Ladder program



Input method





Operand	Available device																		Index modification
	Bit device							Word device							Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
S	○	-	○	-	-	-	○	○	○*2	-	-	-	-	-	○	○	○	○	○	○
D1	○	-	○	-	-	-	○	○	○*2	-	-	-	-	-	○	-	-	○	○	○
D2	○	-	○	-	-	-	○	○	○*2	○	○	-	-	-	○	-	-	○	○	○

Operand	Description
S	Specify the leading No. of the devices storing character string data. *1
D1	Specify the leading device to store the converted CIP character string type data. *1
D2	Specify the device to store CIP character string type data size (number of bytes) stored in D1 after conversion.

*1 If bit device is specified, please specify the leading device of the channel.

*2 EM, FM and ZF cannot be used with the KV Nano Series.

Point

The command can be used in CPU unit with function version 2 or above.

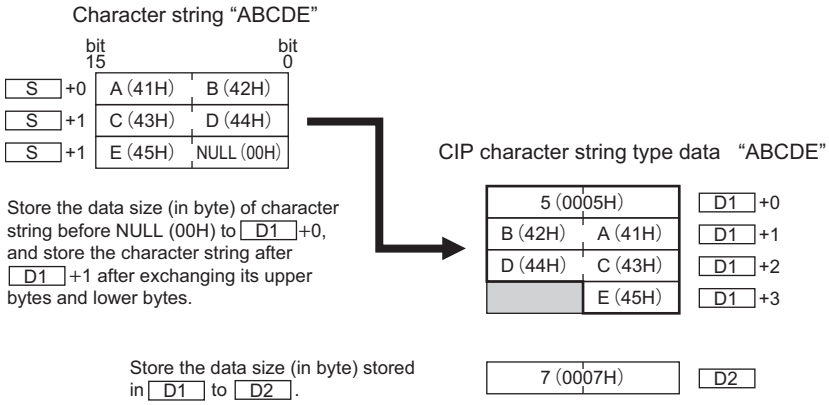
Operation Description

RCPSASC

If execution condition is ON, convert character string data stored in S to CIP character string type data, and store it with the device specified by D1 as the leading one. After conversion, store the data size (byte number) of the character string type data of the CIP stored to the D1 to the device specified by the D2. RCPSASC command is used to convert character string data to CIP character string type data.

For CIP data type, see "Data Type and Device Storage Mode", page 4-172.

Example **The following takes character string as an example to describe the operation of RCPSASC command.**



@RCPSASC Only one scan is executed at the rising edge of execution condition.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON when any of the following conditions is satisfied, otherwise, it is OFF. • If bit device is specified for S1 and D1, the device other than the leading device of the channel is specified • There is no NULL (00H) at the end of the character string stored in S • The length of the character string stored in S is 0 • The range of indirect specifying and index modification is inappropriate

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

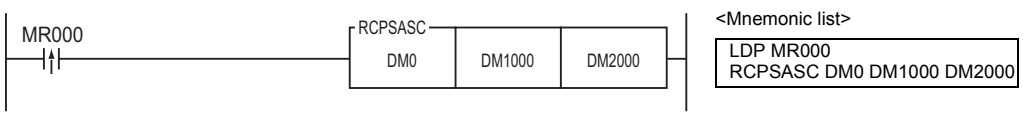
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

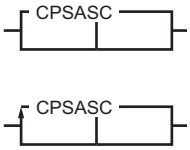
Sample Program

If input relay MR000 is ON, convert the character string stored behind DM0 into CIP character string type data, store it in devices behind DM1000, and store the number of data behind DM1000 in DM2000 (in byte).



CPSASC

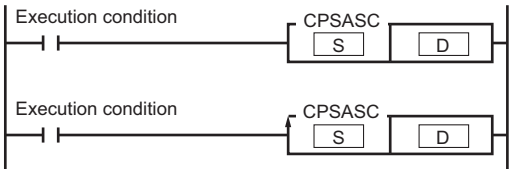
@CPSASC



Conversion of CIP character string type data

Convert CIP character string type data to character string data.

Ladder program



Input method

C P S A S C ␣ S ␣ D ↵

@ C P S A S C ␣ S ␣ D ↵

Operand	Available device																		Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
S	○	-	○	-	-	-	○	○	○*2	-	-	-	-	-	○	-	-	○	○	○
D	○	-	○	-	-	-	○	○	○*2	-	-	-	-	-	○	-	○	○	○	○

Operand	Description
S	Specify the leading No. of the devices that stores CIP character string type data. *1
D	Specify the leading device to store the converted data. *1

*1 If bit device is specified, please specify the leading device of the channel.

*2 EM, FM and ZF cannot be used with the KV Nano Series.

Point

The command can be used in CPU unit with function version 2 or above.

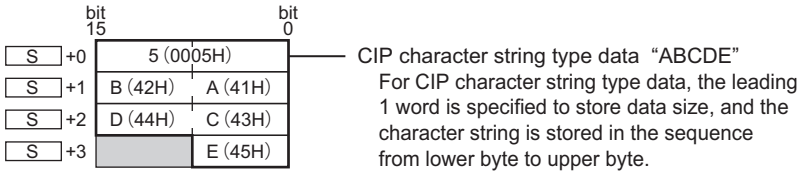
Operation Description

CPSASC

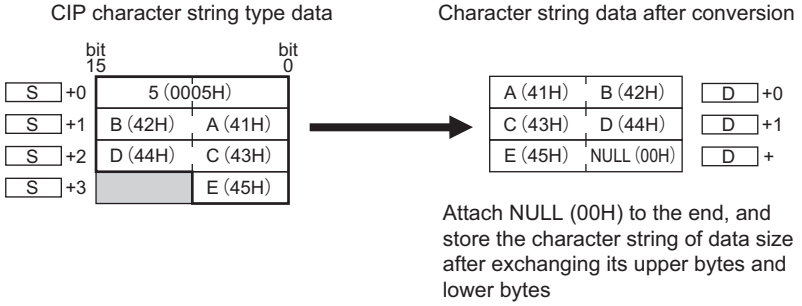
If execution condition is ON, convert CIP character string type data stored in S, and store it in the device with the device specified by D as the leading device.
CPSASC command is used to convert CIP character string type data.
For CIP data type, see "Data Type and Device Storage Mode", page 4-172.

Example **The following takes the CIP character string type data as the example to describe the operation of the CPSASC command.**

CIP character string type data



If CPSASC command is executed, CIP character string type data is converted and stored.



@CPSASC Only one scan is executed at the rising edge of execution condition.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON when any of the following conditions is satisfied, otherwise, it is OFF. • If bit device is specified for S and D, the device other than the leading device of the channel is specified • The data size specified by the leading word of S is 0 or above 2000 • The range of indirect specifying and index modification is inappropriate

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

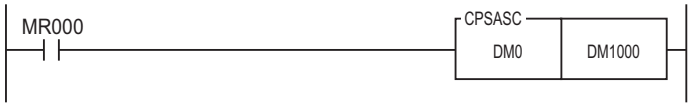
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

Sample Program

If input relay MR000 is ON, CIP character string type data stored in devices behind DM0 is converted, and stored in devices behind DM1000.



<Mnemonic list>

```
LD MR000
CPSASC DM0 DM1000
```

Function Related with CIP Data

■ Function list related with CIP messages

Function/Feature	Function	Operation	Page
CIP message creation	CPMSET	Create the data to be sent in CIP explicit messages.	4-189
CIP message acquisition	CPMGET	Acquire character string data and numerical data from the data received in CIP explicit messages.	4-191

■ Function list related with CIP character string type data

Function/Feature	Function	Operation	Page
Inverse conversion of CIP character string	RCPSASC	Convert character string data to CIP character string type data.	4-193
Conversion of CIP character string	CPSASC	Convert CIP character string type data to character string data.	4-195

CPMSET CIP message creation

CPMSET ([execution condition]*1, input data storage device, parameter, output data storage device)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
S1	Input data storage device *2	Specify the leading device No. to add data.	.U	.S	.D	.L	.F	.DF	.B	.T	-	○	-
S2	Parameter	Specify data type and data size (in byte) of the send data to be added or its storage device. *2	.U	.U	.U	.U	-	-	-	-	○	○	○
D	Output data storage device *2	Specify the leading device to create send data.	.U	.S	.D	.L	.F	.DF	.B	.T	-	○	-
R	Return value	None	-	-	-	-	-	-	-	-	-	-	-

*1 [ ] can be omitted. (If execution condition is omitted, function is executed in each scanning)

*2 If bit device is specified, please specify the leading device of the channel.

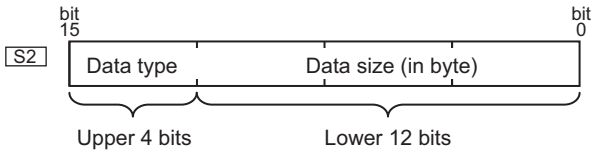
Operation Description

When the execution condition is TRUE, add the data stored in the S1 input data lead storage device by the data type specified by the upper 4 bits of the S2 parameter, and the data size specified by the lower 12 bits to the area behind the data size (bit type) stored to the D output data lead storage device.

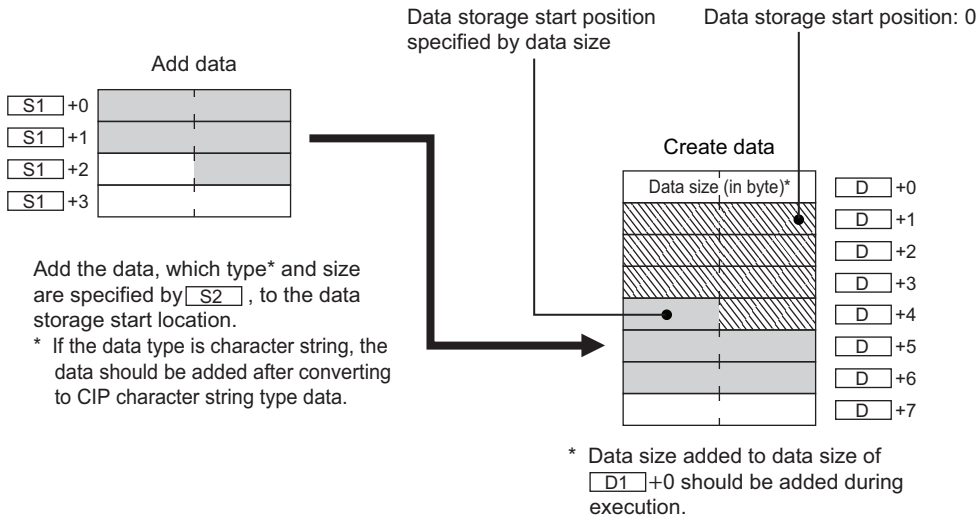
When adding data for the first time, firstly Store 0 in D, then execute the function.

CPMSET function is used to create character string data and numerical data in CIP data type.

For CIP data type, see "Data Type and Device Storage Mode", page 4-172.



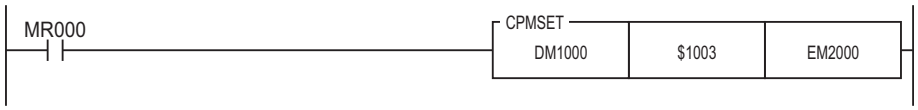
Upper 4 bits	Lower 12 bits
0: non character string	1-4095 (001H-FFFH): specify data size
1: Character string	0-1999 (000H-7CFH): specify number of characters to convert to CIP character string type data If 0 is specified, characters before NULL (00H) will be converted. If the specified number of characters contains NULL (00H), 00H will be added to the characters behind NULL (00H).
2 or above: reserved for system	-



For details, see "CPMSET command (CIP message creation)" (page 4-175).

● Format example

CPMSET(MR0,DM1000,$1003,EM2000)



CPMGET CIP messages acquisition

CPMGET ([execution condition] *1, input data storage device, parameter, input data offset, output data storage device)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
S1	Input data storage device *2	Specify the leading device No. to store the received data.	.U	.S	.D	.L	.F	.DF	.B	.T	-	○	-
S2	Parameter	Specify data type and data size (in byte) of the receive data to be acquired or its storage device.	.U	.U	.U	.U	-	-	-	-	○	○	○
D1	Receive data byte offset *2	Specify the device to specify byte offset from the leading device to specify receive data acquisition position or its storage device.	.U	.S	.D	.L	-	-	-	-	-	○	-
D2	Output data storage device *2	Specify the leading device of the devices to store the acquired data.	.U	.S	.D	.L	.F	.DF	.B	.T	-	○	-
R	Return value	None	-	-	-	-	-	-	-	-	-	-	-

*1 [ ] can be omitted. (If execution condition is omitted, function is executed in each scanning)

*2 If bit device is specified, please specify the leading device of the channel.

Operation Description

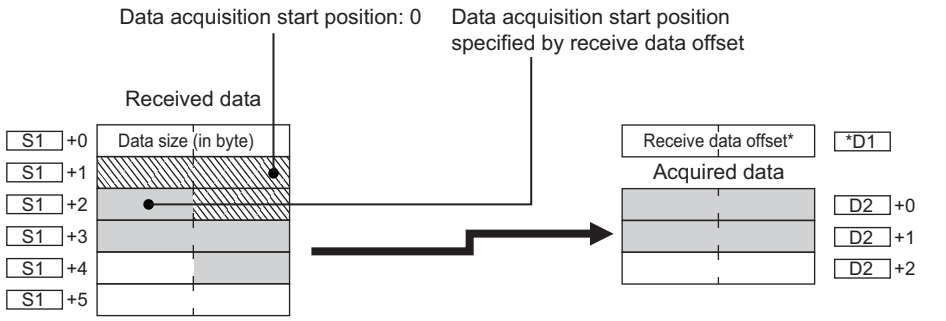
If execution condition is TRUE, store the data after the offset position specified by the received data offset in D1 of the received data stored in the S1 input data storage lead device. Store the data size (bit unit) specified by the lower 12 bits of the S2 parameter into the D2 output data storage lead device by using the data type specified by the upper 4 bits of the S2 parameter. After data is stored, D1 will be updated.

CPMGET function is used to acquire the received character string data and numerical data in CIP data type.

For CIP data type, see "Data Type and Device Storage Mode", page 4-172.



upper 4 bits	lower 12 bits
0: non character string	1-4095 (001H-FFFH): specify data size
1: Character string	0-1999 (000H-7CFH): specify number of characters to convert to CIP character string type data If 0 is specified, characters before NULL (00H) will be converted. If the specified number of characters contains NULL (00H), 00H will be added to the character behind NULL (00H).
2 or above: reserved for system	-



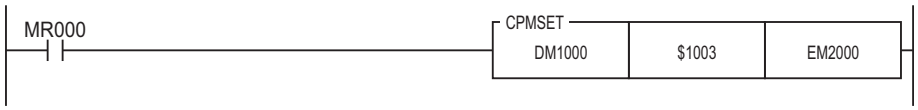
Acquire data, which type* and size are specified by S2, from the position after data acquisition start position of D1, and store it in devices after D2.
* If the data type is character string, the data should be converted to CIP character string type data.

* Data size acquired from receive data offset of D1 should be added during execution.

For details, see "CPMGET command (CIP messages acquisition)" (page 4-180).

- **Format example**

CPMGET(MR0, EM2000, $1003, DM1000, DM2000)



RCPSASC Inverse conversion of CIP character string

Return value *1=**RCPSASC** (object data storage device, data storage device after conversion)

Argument/return value		Description	Type								Constant	device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
S	Conversion object data storage device	Specify the leading device No. to store the character string before conversion.	-	-	-	-	-	-	-	.T	*3 ○	○	-
D	Data storage target device after conversion*2	Specify the leading device No. to store the converted CIP character string type data.	.U	.S	.D	.L	.F	.DF	.B	.T	-	○	-
R	Return value	Store the number of characters (in byte) stored in D. RCPSASC function adopts .U type data.	.U	.S	.D	.L	.F	.DF	-	-	-	-	-

*1 Return value can be omitted. When omitted, the conversion result is stored in work device/work memory.

*2 If the specified data type for return value is not .U, data type is converted automatically during conversion.

*3 If a constant is specified for the character string, please use " " to enclose it.

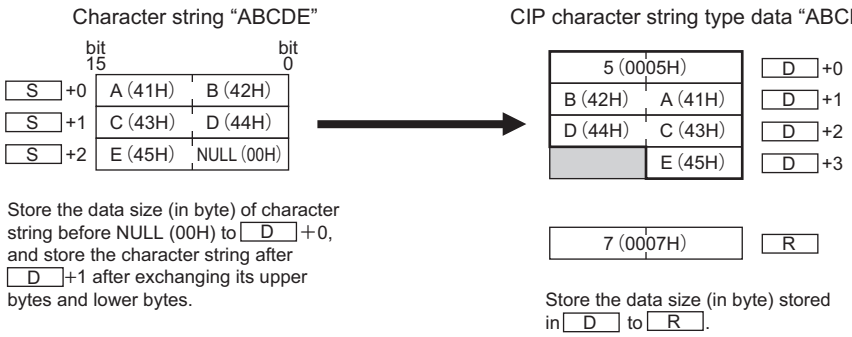
Operation Description

Convert the CIP character string data stored in the S lead convert object data storage device, and store the result in the D lead converted data storage device.Store the number of characters (in byte) stored in D after conversion in R.

RCPSASC function is used to convert character string to CIP character string type data.

For CIP data type, see "Data Type and Device Storage Mode", page 4-172.

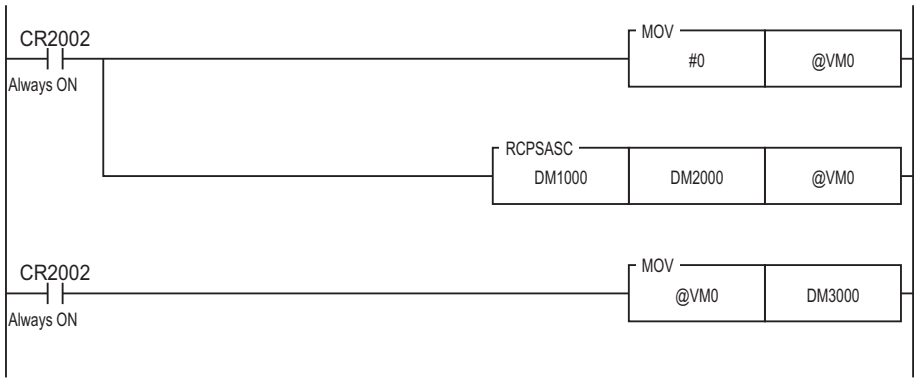
If RCPSASC function is executed, the character string will be converted to CIP character string type data.



For details, see "RCPSASC command (CIP character string type data conversion)" , page 4-184.

● Format example

DM3000 = RCPSASC(DM1000.T, DM2000)



CPSASC Conversion of CIP character string

Return value*1=**CPSASC** (object data storage device)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
S	Conversion object data storage device*2	Specify the leading device No. to store CIP character string type data before conversion.	.U	.S	.D	.L	.F	.DF	.B	.T	-	○	-
R	Return value	CPSASC function adopts .T type data.	-	-	-	-	-	-	-	.T	-	-	-

*1 Return value can be omitted. When omitted, the conversion result is stored in word device/word memory.

*2 If bit device is specified, please specify the leading device of the channel.

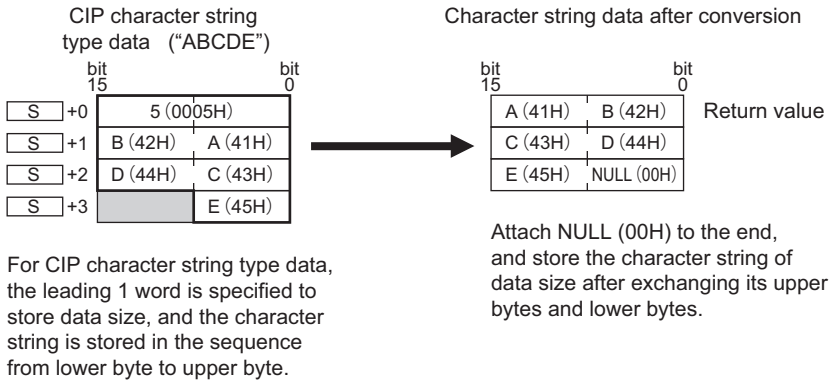
Operation Description

Convert the character string type data of the CIP stored as the leading device specified by the S convert object data storage leading device to a character string. Store the result in the R return value.

CPSASC function is used to convert CIP character string type data to character string for processing.

For CIP data type, see "Data Type and Device Storage Mode", page 4-172.

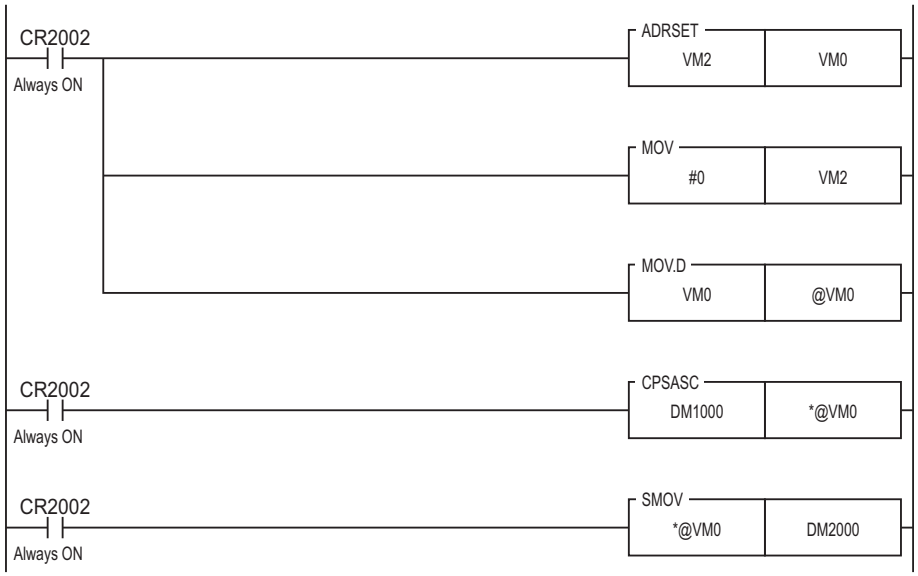
If CPSASC function is executed, CIP character string type data will be converted, and stored in the return value.



For details, see "CPSASC command (CIP character string type data conversion)", page 4-186.

● Format example

DM2000.T = CPSASC(DM1000)



5

HOW TO USE EtherNet/IP SETTING

Cyclic (I/O) messages between EtherNet/IP Units and EtherNet/IP Devices and other functions can be set up using the EtherNet/IP Settings attached to KV STUDIO. This chapter describes how to operate EtherNet/IP Setting.

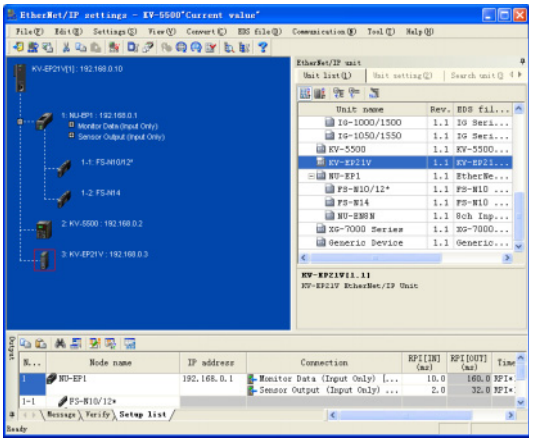
5-1 EtherNet/IP Setting. 5-2
5-2 Startup and Exit of EtherNet/IP Setting 5-7
5-3 Name and Function of Parts of Screen 5-8
5-4 Scan List Area 5-9
5-5 EtherNet/IP Device Area 5-15
5-6 Setting 5-31
5-7 Output Window. 5-36
5-8 File 5-46
5-9 Edit 5-48
5-10 Convert. 5-51
5-11 Communication/Tool. 5-53
5-12 Transmission Adapter Settings 5-56
5-13 Calculate Cyclic (I/O) Messages Load Factor 5-67
5-14 View/Help 5-72

5-1 EtherNet/IP Setting

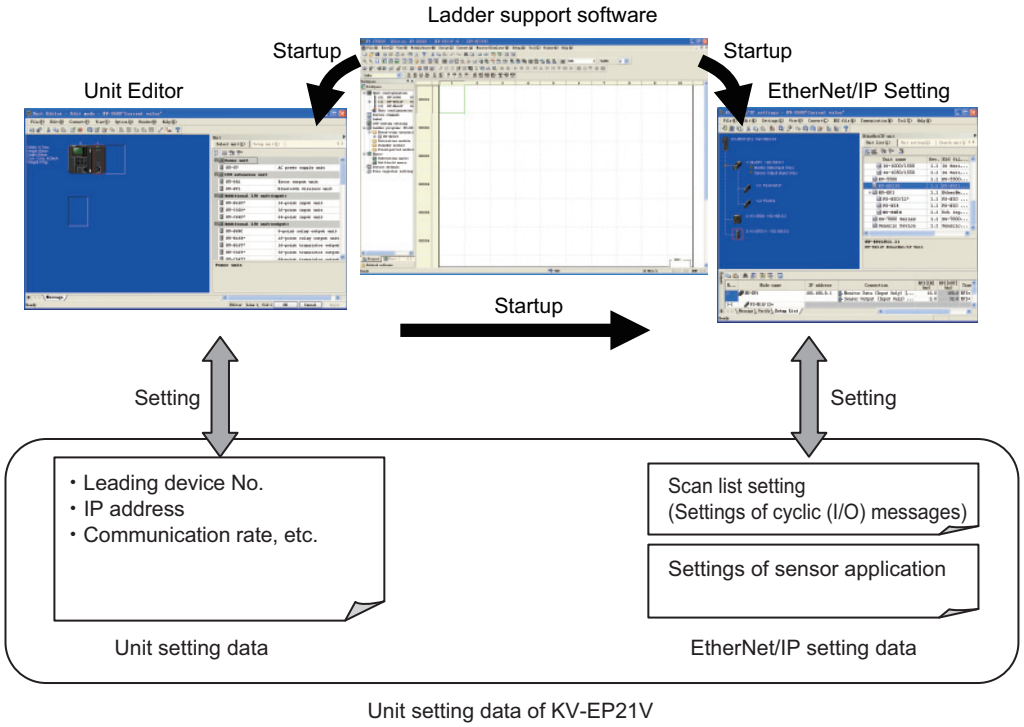
This section describes how to use EtherNet/IP Setting.

What is EtherNet/IP Settings

The EtherNet/IP Setting tool is used to set up the scan list for cyclic (I/O) messages between EtherNet/IP Units and EtherNet/IP Devices, as well as set up sensor application functions.



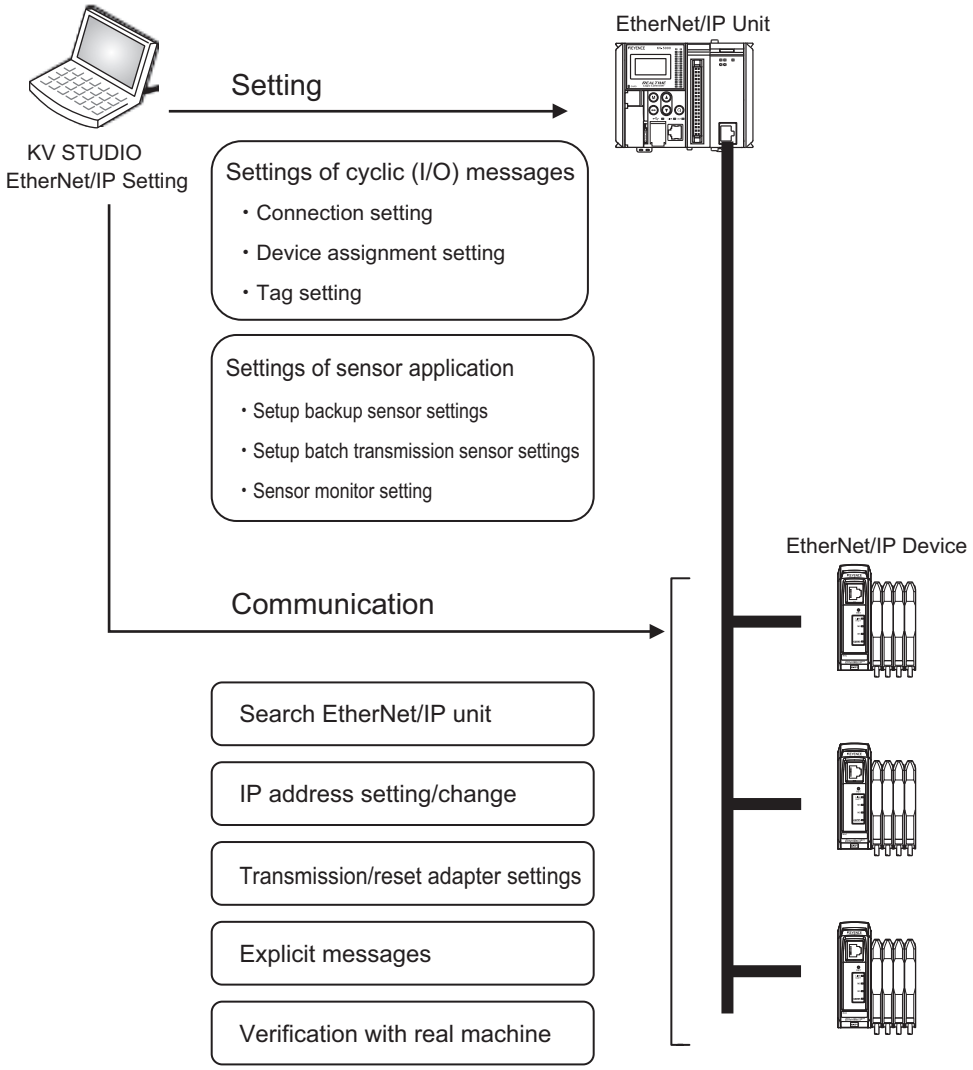
EtherNet/IP Setting starts up from Ladder support software KV STUDIO.
It can be operated after getting the EtherNet/IP Unit information from "Unit setting data" of the project opened currently in the Ladder support software.



Unit setting data of KV-EP21V

Function of EtherNet/IP Setting

The following describes the function of EtherNet/IP Setting.



Tool

- Read and verification of backup sensor settings file
- Calculate cyclic (I/O) messages load factor
- Startup of KV DATALINK+ for EtherNet/IP

Setting Procedures

■ Before setting up with EtherNet/IP Setting

Setting up with Unit Editor is required before setting up with "EtherNet/IP Setting".

Unit installation

Connect the EtherNet/IP Unit and the required EtherNet/IP Device to Ethernet;

"2-2 Installing on CPU Units (base unit)", page 2-3

"2-3 Connecting to Ethernet", page 2-8

EtherNet/IP Unit setting

Execute EtherNet/IP Unit setting in Unit Editor.

"Chapter 3 UNIT SETTING", 3-1

Startup of EtherNet/IP Setting

Start up EtherNet/IP Setting and set up cyclic (I/O) messages and sensor application.

"Startup and Exit of EtherNet/IP Setting", page 5-7

■ Setting procedures of cyclic (I/O) messages

The following describes the setting procedures when creating the scan list for cyclic (I/O) messages with EtherNet/IP Setting. The EDS file of each EtherNet/IP Device is required for creating the scan list.

Reference For the procedure from setting cyclic (I/O) messages, including EtherNet/IP Unit setting, to operation, see

"From Cyclic (I/O) Messages Setting Steps to Operation", page 4-9.

Start up EtherNet/IP Setting.

"Startup and Exit of EtherNet/IP Setting", page 5-7

Register EDS file to EtherNet/IP Setting. (For the first registration of unit from other companies only)

" Register to "Unit List" tab of EtherNet/IP Device (EDS file)", page 5-18

EDS file can be registered with "Unit List" tab.
EDS file of EtherNet/IP Device is available on the vendors' websites.
ESD file needs to be registered once only.

Point

EDS file of EtherNet/IP Device from KEYENCE is registered at the time of update of KV STUDIO, or by selecting "File" -> "Register sensor settings file", and then selecting ez1 file.

Register EtherNet/IP Device to scan list.

"Register Unit to Scan List", page 5-12
"Search Unit", page 5-26

EDS file can be registered by dragging and dropping it directly from "Unit List" tab or "Search Unit" tab.
Default setting for communication and device assignment can be executed automatically when registering EDS file.

Reference With the "Search Unit" tab, you can search EtherNet/IP Devices connected to the EtherNet/IP Unit, and create a scan list.

Setting finished

Change the setting of cyclic (I/O) messages as required.

"Connection Settings", page 5-31
"Device Assignment Settings", page 5-33
"Tag Settings", page 5-32

The setting of cyclic (I/O) messages is completed with the above steps.
Exit EtherNet/IP Setting and transfer projects from KV STUDIO to CPU unit.

■ Setting procedures of sensor application function

The following describes the setting procedure of sensor application function using EtherNet/IP Setting. When using sensor application function, scan list setting for cyclic (I/O) messages is required to be set up.

Set up the scan list for cyclic (I/O) messages.

"Setting procedures of cyclic (I/O) messages", page 5-5

Sensor application function can be executed to the sensor (adapter) registered in the scan list.

Execute setting related to sensor application function.

"Setting Details of Backup Sensor Settings", page 7-11
"Setting Details of Batch Transmission Sensor Settings", page 7-51
"Settings of Sensor Monitor Function", page 7-43

Reference No setting is required when using sensor setting command.

Setting end

The setting of sensor application function is completed with the above steps.
Exit EtherNet/IP Setting and transfer projects from KV STUDIO to CPU unit.

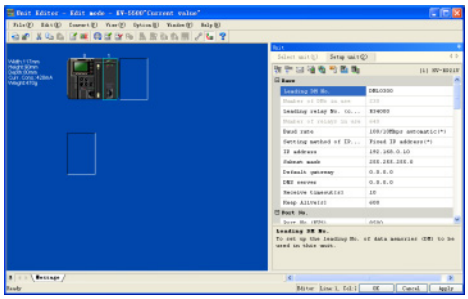
5-2 Startup and Exit of EtherNet/IP Setting

This section describes how to start up and exit EtherNet/IP Setting.

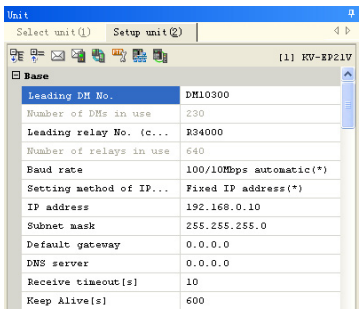
Startup of EtherNet/IP Setting

1 Check the EtherNet/IP Unit setting.

Before starting up EtherNet/IP Setting, please check whether KV-EP21V setting is correct using Unit Editor of KV STUDIO.



2 Click icon in "Setup unit (2)" tab of Unit Editor to start up EtherNet/IP Setting.



Other procedure
- Double click the EtherNet/IP adapter unit (slot unit) connected to KV-EP21V in the workspace of KV STUDIO.
- Right-click the unit to be set up in the workspace of KV STUDIO, and select "EtherNet/IP Setting" from the menu displayed.
- Right-click the unit to be set up in Unit Editor, and select "EtherNet/IP Setting" from the menu displayed.
- Select "Tool(T)" -> "EtherNet/IP Setting(W)" from the menu to start EtherNet/IP Unit Setting.

Exit EtherNet/IP Setting

1 Click on "File(F)" ▶ "Close(C)" from the menu of EtherNet/IP Setting to exit.

Other procedure
- Click on the right of titlebar of EtherNet/IP Setting to exit.
- Click on the toolbar of EtherNet/IP Setting to exit.
- Press Alt + F4 key on the keyboard

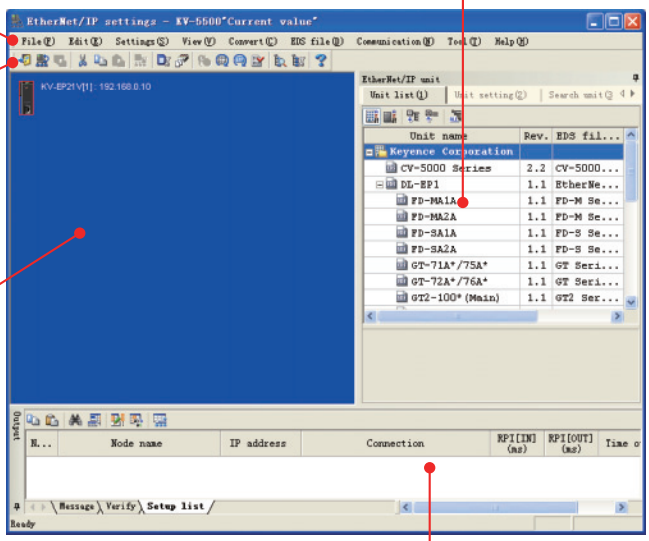
Screen configuration of "EtherNet/IP Setting" is as follows.

EtherNet/IP Device area
Configuration and setting change of EtherNet/IP Device, as well as search of EtherNet/IP Device actually connected can be executed on "Unit List" tab, "Unit Setting" tab and "Search Unit"

Menubar
Display the menuto execute various functions .

Toolbar
Buttons to execute various functions display side by side.

Scan list area
Display EtherNet/IP devices connected to EtherNet/IP Units in a tree structure.



Output window
Display the errors during operation, verification results (in case verification function is used), and the setting list of EtherNet/IP Device.
"Message" window
Display setting check details.
"Verify" window
Display verification result.
"Setting List"
Display setting list of EtherNet/IP Device.

● Auto-hide function

By clicking the pin icon on the upper right of EtherNet/IP Device area and output window, EtherNet/IP Device area and output window will be displayed when required.

Icon	Description
	Keep display status of the output window and EtherNet/IP Device area.
	After the screen is changed into tab in directions of up, down, left and right, EtherNet/IP Device area and output window will be displayed. It is displayed by moving the cursor to tab, or double-clicking tab.

5-4 Scan List Area

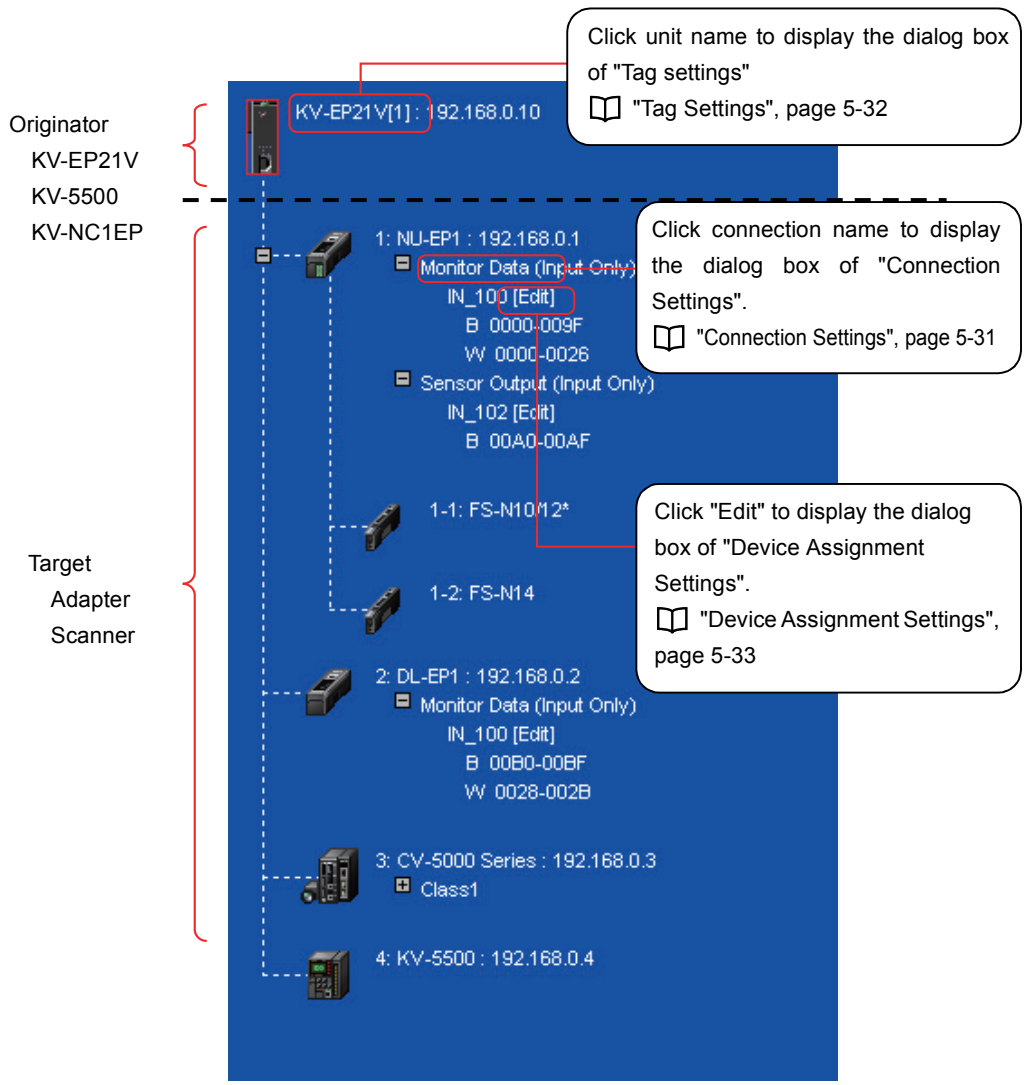
This section describes display contents and operation for scan list.

Overview of Scan List Area

The unit configuration of scan list is displayed in scan list area.

The following display and operation are available in the scan list area.

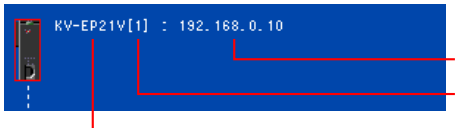
- Configure units from "Unit List" tab and delete unit from scan list
- Display IP address, node address, node name, (slot No.) and connection name
- Display the device assigned in connection setting and the dialog box of "Device Assignment Setting"
- Select units for performing various functions
- Display the dialog box of "Connection Setting" of target units (adapter, scanner)
- Display the dialog box of "Tag setting" of the originator unit (EtherNet/IP Unit)
- Display rack configuration unit in tree structure
- Reserve EtherNet/IP Device



Display Contents of Scan List Area

■ Display contents of originator unit

The EtherNet/IP Unit is displayed.



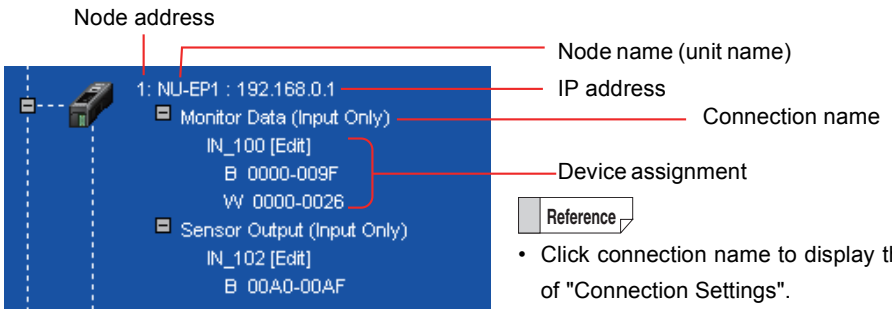
Reference

Click unit name to display the dialog box of "Tag settings".

" Tag Settings", page 5-32

■ Display contents of target unit

● Display contents of adapter



Reference

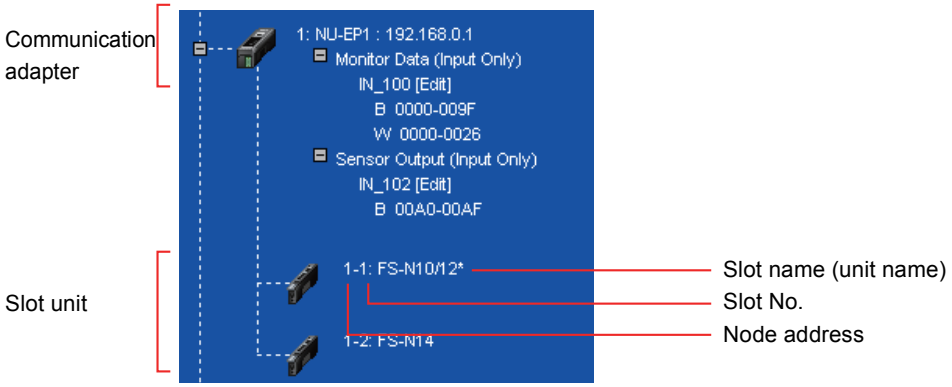
- Click connection name to display the dialog box of "Connection Settings".

" Connection Settings", page 5-31

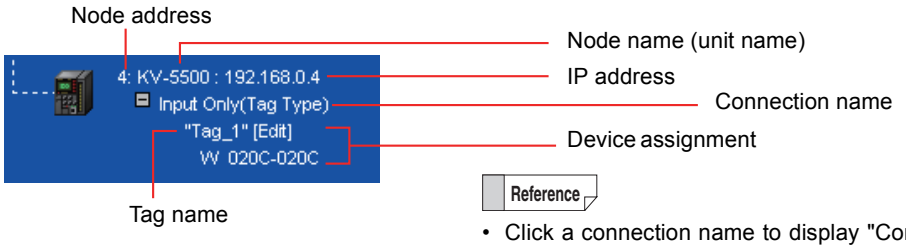
- Click "Edit" to display the dialog box of "Device Assignment Settings".

" Device Assignment Settings", page 5-33

For rack configuration unit, the slot unit is displayed in tree structure after clicking .



● Display contents of scanner unit



Reference

- Click a connection name to display "Connection Settings" dialog box.
  " Connection Settings", page 5-31
- Click "Edit" to display the "Device Assignment Settings" dialog box.
  " Device Assignment Settings", page 5-33

● Display of unknown EtherNet/IP Device

It is displayed when registering unknown EtherNet/IP Device.



When reading projects from CPU unit with KV STUDIO, if "EtherNet/IP Setting" includes an EtherNet/IP Device with unregistered EDS file, it will be displayed as unknown EtherNet/IP Device.
After the EDS file of target EtherNet/IP Device is registered to "EtherNet/IP Setting", it will be displayed correctly.

● Display of EtherNet/IP Device



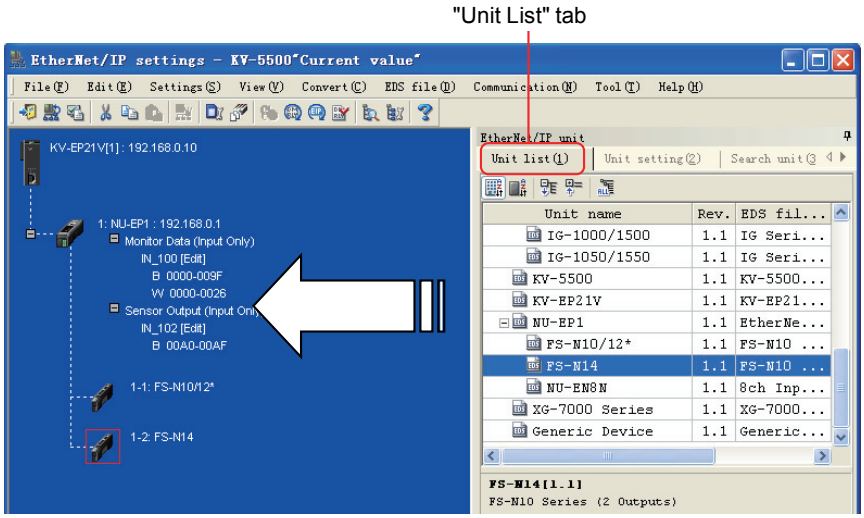
When opening project from KV STUDIO or reading project from CPU unit, if the EDS file of a unit configured in scan list differs from the EDS file registered in "EtherNet/IP Setting", it will be displayed as error EtherNet/IP Device.
Generally, no error EtherNet/IP Device is displayed.
When displaying error EtherNet/IP Device, error may be removed by executing the "EDS file synchronization" in "Property" dialog box.

Register Unit to Scan List

The following describes how to register EtherNet/IP Devices connected to EtherNet/IP Units from the "Unit List" tab in the EtherNet/IP Device area.

■ Register

Select EtherNet/IP Device to be connected from the "Unit List" tab in the EtherNet/IP Device area to drag-and-drop to scan list area.



Other procedure
- Select EtherNet/IP Device from the "Unit List" tab, select "EDS file(D)" ▶ "Add to scan list(A)" from the menu.
- Select EtherNet/IP Device from the "Unit List" tab, and select "Add to scan list" from the right-click menu.
- Select EtherNet/IP Device from the "Unit List" tab, then double click or press Enter key.

Point

- **The unit can be inserted to the corresponding location by dragging and dropping. In other cases, it will be configured under the selected adapter.**
- **The slot unit which cannot be connected to the adapter (communication adapter) in the location inserted or scan list can not be configured.**
- **The number after the number assigned to the last unit configured will be assigned when assigning node address and IP address.**

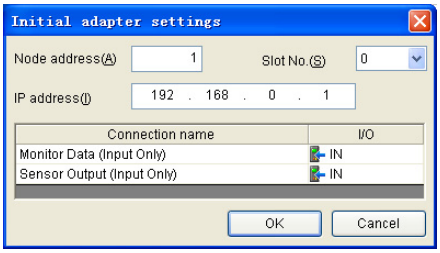
Reference

When using the "Search Unit" tab in the EtherNet/IP Device area, the EtherNet/IP Device connected to the EtherNet/IP Unit can be searched to create a scan list.

" "Search Unit" Tab", page 5-24

● Initial adapter setting dialog box

When registering EtherNet/IP Device which can be connected, the "Initial adapter settings" dialog box is displayed.

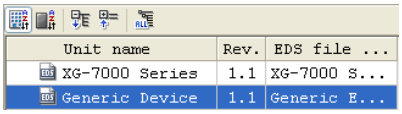


Item	Description
Node address	The number after the number assigned to the last unit configured will be assigned during configuration. The node address assigned can be changed as well. Node address is used for identifying EtherNet/IP Devices in the EtherNet/IP Unit.
Slot No.	In case EtherNet/IP is displayed as rack configuration unit, the smallest slot No. will be assigned during configuration. The assigned slot No. can be changed as well.
IP address	The number after the number assigned to the last unit configured will be assigned during configuration. The assigned IP address can be changed as well.
Connection name	Display the connection setting set up in the EtherNet/IP Device. If the EtherNet/IP Device is from KEYENCE, the default connection setting defined in EDS file is displayed; if the EtherNet/IP Device is from other companies, the first connection setting defined in EDS file is displayed.
I/O	Connection setting can not be changed here. In case the default connection can not be set up, "There is no default connection set" is displayed. For the change of connection setting, see "Connection Settings", page 5-31.
"OK"	Click to register unit with entered setting.
"Cancel"	Click to unregister unit.

Reference

When using EtherNet/IP Device which is unable to get EDS file, use "Generic Device" registered in "Unit List" tab. Depending on the EtherNet/IP Device actually used, communication is available after setting up connection point and data size of Generic Device in the parameter setting of "Connection Setting" dialog box. When communicating with Generic Device, compatibility check is not executed.

Exclusive Owner and Input Only (including tab specifying) can be set up as connection; however, EDS file of rack configuration unit can not be used.



Deletion of EtherNet/IP Device

Edit(E) ▶ Delete(D) Delete

Deletes the EtherNet/IP Device registered in the scan list. Select the unit to be deleted, and select "Edit(E)" ▶ "Delete(D)" from the menu or select "Delete" from the right-click menu.

Point

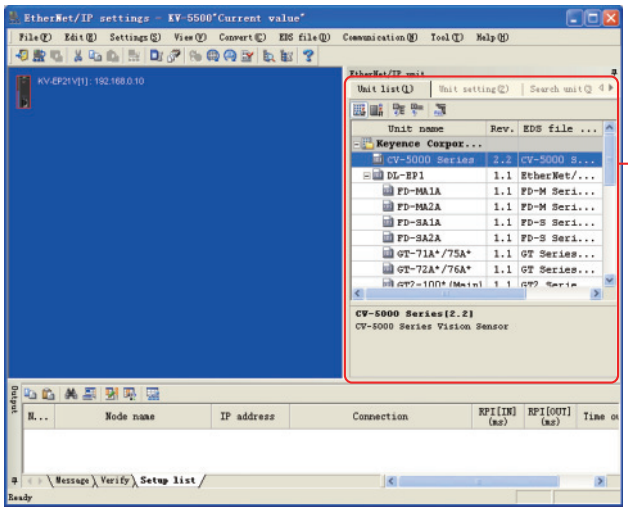
After deleting the unit, the device assigned to the unit will not be changed. In case the device assignment needs to be changed, both auto assignment and manual assignment of device can not be executed.

5-5 EtherNet/IP Device Area

This section gives a general description of the display contents and operations of EtherNet/IP Device area.

Overview of EtherNet/IP Device Area

In the EtherNet/IP Device area, you can use "Unit List" tab, "Unit Setting" tab and "Search Unit" tab to carry out the following display and operation.



EtherNet/IP Device area

- "Unit List" tab
- "Unit Setting" tab
- "Search Unit" tab

Display and operations of "Unit List" tab ""Unit List" Tab", page 5-16

- Display EtherNet/IP Device with registered EDS file
- Configure the scan list of EtherNet/IP Device
- Registration and deletion of EtherNet/IP Device (EDS file)

Display and operations of "Unit Setting" tab ""Unit Setting" Tab", page 5-22

- EtherNet/IP Unit setting.
- Display "Tag settings" dialog box
- Display the "Setup backup sensor settings", "Setup batch transmission sensor settings" dialog box
- Adapter and scanner setting on the target side
- Display "Connection Setting" dialog box

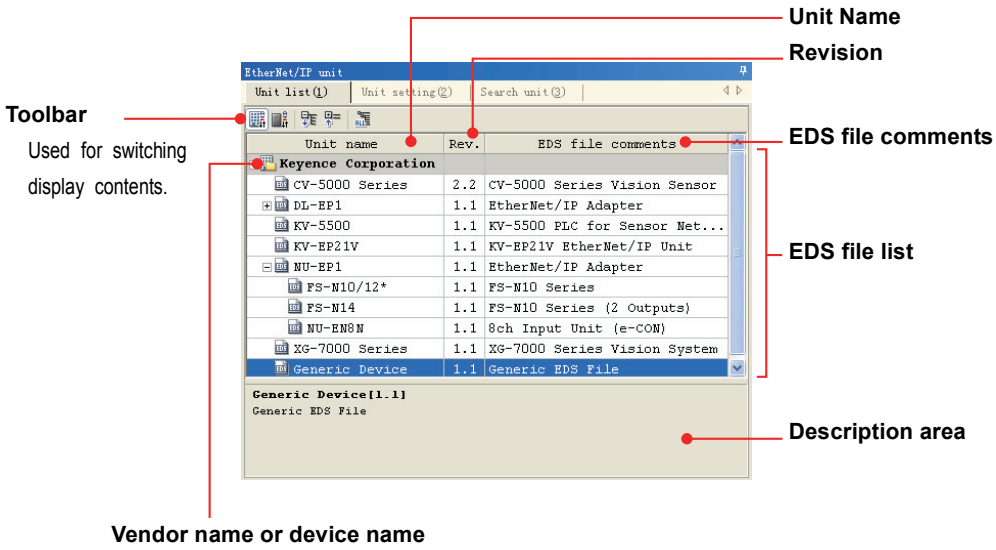
Display and operations of "Search unit" tab ""Search Unit" Tab", page 5-24

- Check EtherNet/IP Device
- IP address setting of the EtherNet/IP Device searched
- Configure the scan list of the EtherNet/IP Device searched
- Send reset message to EtherNet/IP Device searched

"Unit List" Tab

In the "Unit List" tab, the EtherNet/IP Device with registered EDS file is displayed.
Use "Unit List" tab to register unit to the scan list.

Name and Function of "Unit List" Tab



Item	Description
Vendor name *1	Display the vendor name (manufacturer name) of EtherNet/IP Device. Example) Keyence Corporation
Device name*2	Display device type of EtherNet/IP Device. Example) Generic Device, etc.
Unit name	Display EtherNet/IP Device name.
EDS file comments	Display EDS file comments of EtherNet/IP Device. Select "EDS file" ▶ "Edit comments" from the menu to change it.
Revision	The revision of EtherNet/IP Device is displayed in the format of "MajRev. MinRev". The number of revision means the version of functions added to EtherNet/IP Device.
Description area	Display unit name and EDS file comments of the EtherNet/IP Device selected.

*1 It is displayed in case of display by vendor.

*2 It is displayed in case of display by equipment.

Switch Display of EtherNet/IP Device

Display by vendor
Device-wise Display by equipment
Open all
Close all
Display all EDS files/display latest revision

The display contents can be changed using the toolbar of "Unit List" tab.

■ Displayed by vendor /displayed by equipment

When it is set to displayed by vendor , it is displayed as per vendor name (Example Keyence Corporation).
When it is set to displayed by equipment , it is displayed as per equipment type (Example Generic Device).

Displayed by vendor

Unit name	Rev.	EDS file ...
Keyence Corpor...		
CV-5000 Series	2.2	CV-5000 S...
DL-EP1	1.1	EtherNet/...
KV-5500	1.1	KV-5500 P...
KV-EP21V	1.1	KV-EP21V ...
NU-EP1	1.1	EtherNet/...
FS-N10/12*	1.1	FS-N10 Se...

Displayed by equipment

Unit name	Rev.	EDS fil...
Generic Device		
CV-5000 Series	2.2	CV-5000...
DL-EP1	1.1	EtherNe...
NU-EP1	1.1	EtherNe...
FS-N10/12*	1.1	FS-N10 ...
FS-N14	1.1	FS-N10 ...
NU-EN8N	1.1	8ch Inp...

■ Display all EDS files/Display latest revision

When it is set to display all EDS files, chassis of all rack configuration units, and EtherNet/IP Device (EDS file) of different revisions will be displayed.
When it is set to display latest revision, chassis unit will not be displayed, only the newest EtherNet/IP Devices (EDS file) of all major revisions are displayed.

Display all EDS files

Unit name	Rev.	EDS file ...
KV-EP21V	1.1	KV-EP21V ...
NU Chassis	1.1	
NU-EP1	1.1	EtherNet/...
FS-N10/12*	1.1	FS-N10 Se...
FS-N14	1.1	FS-N10 Se...
NU-EN8N	1.1	8ch Input...

Display the latest revision

Unit name	Rev.	EDS file ...
Keyence Corpor...		
CV-5000 Series	2.2	CV-5000 S...
DL-EP1	1.1	EtherNet/...
KV-5500	1.1	KV-5500 P...
KV-EP21V	1.1	KV-EP21V ...
NU-EP1	1.1	EtherNet/...
FS-N10/12*	1.1	FS-N10 Se...

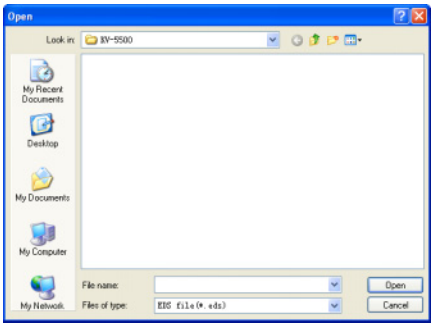
Other procedure Select "EDS file(D)" ▶ "Display all EDS files(V)"/"Display latest revision(V)" from the menu.

Register to "Unit List" tab of EtherNet/IP Device (EDS file)

EDS file(D) ▶ Register(T)

1 Select "EDS file(D)" ▶ "Reg(T)" from the menu.

The "Open file" dialog box is displayed. Select EDS file of EtherNet/IP Device to be registered to "Unit List" tab.



Other procedure In the "Unit List" tab, select "Register EDS file" from the right-click menu.

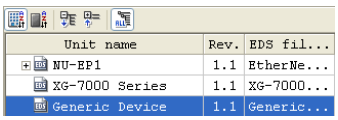
2 Click "Open" button.

The selected EDS file is registered, and EtherNet/IP Device added to the "Unit List" tab.

Reference

- EDS file of EtherNet/IP Device from KEYENCE is registered at the time of update of KV STUDIO, or by selecting "File" -> "Register sensor settings file", and then selecting ez1 file.
- When registering EDS file of EtherNet/IP adapter of rack configuration unit, EDS file of communication adapter, slot unit and chassis unit are required.
- When using EtherNet/IP Device which is unable to get EDS file, use "Generic Device" registered in "Unit List" tab. Depending on the EtherNet/IP Device actually used, communication is available after setting up connection point and data size of Generic Device in the parameter setting of the "Connection Setting" dialog box. When communicating with Generic Device, compatibility check is not executed.

  Exclusive Owner and Input Only (including tab specifying) can be set up as connection; however, EDS file of rack configuration unit can not be used.



Delete EtherNet/IP Device (EDS file) from the "Unit List" tab.

EDS file(D) ▶ Delete(D)

1 Select "EDS file(D)" ▶ "Delete(D)" from the menu.

The EtherNet/IP Device (EDS file) selected from the "Unit List" will be deleted.
EDS file will not only be removed from the "Unit List" tab, but also be deleted from PC. Therefore, it needs re-registration when necessary.

Other procedure In the "Unit List" tab, select "Delete EDS file" from the right-click menu.

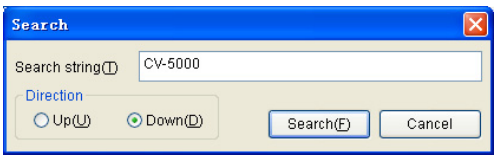
Reference
- EtherNet/IP Device from KEYENCE can not be deleted.
- Even if EtherNet/IP Device has been deleted from the "Unit List" tab, the EtherNet/IP Device configured in the scan list can still be set up.

Search EtherNet/IP Device (EDS file) in the "Unit List" tab

EDS file(D) ▶ Search(S)

1 Select "EDS file(D)" ▶ "Search(S)" from the menu.

Display dialog box of "Search".



2 Input unit name or partial unit name, and then click "Search" button.

The unit name searched in "Unit List" tab will be displayed in highlight.

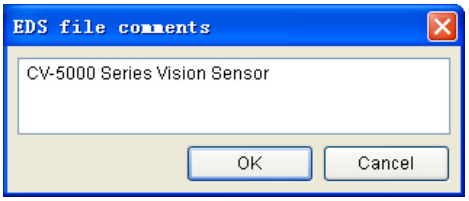
3 Click "Search" button to continue to search.

Edit the comments (EDS file comments) of EtherNet/IP Device

EDS file(D) ▶ Edit comments(E)

1 Select EtherNet/IP Device from the "Unit List" tab, select "EDS file(D)" ▶ "Edit comments(E)" from the menu.

The "EDS file comments" dialog box is displayed.



2 Input EDS file comments, and click on "OK" button.

Setting range: up to 32 full-width characters

Other procedure Select EtherNet/IP Device from the "Unit List" tab, select "EDS file comments" from the right-click menu.

Add EtherNet/IP Device to the scan list

EDS file(D) ▶ Add to scan list(A)

1 Select EtherNet/IP Device from the "Unit List" tab, select "EDS file(D)" ▶ "Add to scan list(A)" from the menu.

The selected EtherNet/IP Device will be registered to the scan list.

Other procedure
- Select EtherNet/IP Device from the "Unit List" tab, and select "Add to scan list" from the right-click menu.
- Drag-and-drop the EtherNet/IP Device in the "Unit List" tab to the scan list area.

Confirm the property of EtherNet/IP Device

EDS file(D) ► Property(P)

1 Select EtherNet/IP Device from the "Unit List" tab, select "EDS file(D)" ► "Property(P)" from the menu.

The "Property" dialog box of the selected unit (EDS file) is displayed. The information of EtherNet/IP Device registered in the "Unit List" tab will be displayed.



Other procedure • In the "Unit List" tab, select "Property" from the right-click menu.

Item	Description
"Change icon"	Change the icon of EtherNet/IP Device. The icon file with extension (.ico) can be used.
"Restore to default"	The icon of EtherNet/IP Device is restored to the initial status.
Note	Display EDS file information of EtherNet/IP Device registered.
Creation time	
Update time	
File revision	
Vendor name	Display information of EtherNet/IP Device registered.
Device type.	
Product code	
Revision	
Catalog	
"Display EDS file"	Display EDS files. The edit contents of the displayed EDS file will not be updated to the registered EDS file.

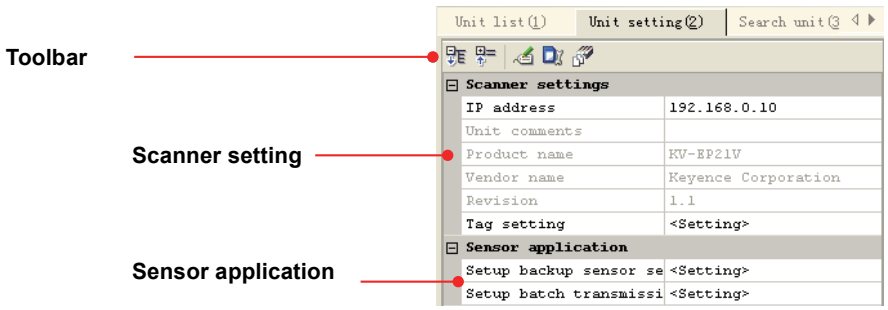
"Unit Setting" Tab

You can use the "Unit Setting" tab to set up the units registered in the scan list.
Different projects are displayed depending on the selected units.

When selecting originator, the "Unit Setting" tab is displayed

View (V) ▶ "Unit Setting(2)" Alt + 2

When selecting originator EtherNet/IP Unit, the "Unit Setting(2)" tab is displayed as follows.

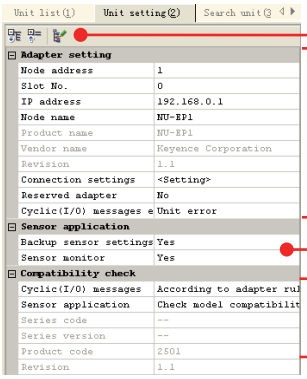


Item		Description
Scanner Setting		
	IP address	Display the IP address of the originator EtherNet/IP Unit. To change it, enter an IP address. The IP address changed here will be updated to the Unit Editor.
	Unit comments	Display unit comments of KV-EP21V set up in Unit Editor of KV STUDIO.
	Product name	Display the unit product name (EtherNet/IP Unit).
	Vendor name	Display vendor name of unit (Keyence Corporation).
	Revision	Unit revision is displayed in the format of "MajRev. MinRev".
	Tag setting	Display "Tag Setting" dialog box. Display button on the toolbar. For the tag setting, see "Tag Settings", page 5-32.
Sensor application		
	Setup backup sensor settings	Display dialog box of the "Setup backup sensor settings". Display button on the toolbar. "Setup backup sensor settings", page 7-12
	Setup batch transmission sensor settings	Display "Setup batch transmission sensor settings" dialog box. Display button on the toolbar. "Setup batch transmission sensor settings", page 7-51

When selecting target, the "Unit Setting" tab is displayed

View (V) ▶ "Unit Setting(2)" Alt + 2

When selecting the adapter or scanner registered as target, the "Unit Setting" tab is displayed as follows. Different projects are displayed depending on the selected units.



Toolbar

Adapter Setting

Sensor application

For sensor application function, see the following pages.

"Setting Details of Backup Sensor Settings", page 7-11
"Settings of Sensor Monitor Function", page 7-43

Compatibility check

For compatibility check, see the following pages.

"Target EtherNet/IP Device Setting", page 4-15
"Compatibility Check for Sensor Application", page 7-5

● Adapter Setting

Item		Description
Adapter Setting		
	Node address *1	Display node address of the unit. It should be entered when making change. Node address is used for identifying EtherNet/IP Devices in KV-EP21V.
	Slot No. *2	Display slot No. of unit. It should be entered when making change.
	IP address *1	Display IP address of unit. It should be entered when making change.
	Node name *1	Display node name of unit. It should be entered when making change.
	Slot name *2*3	Display slot name of unit. It should be entered when making change.
	Product name	Display product name of unit.
	Vendor name	Display vendor name of unit.
	Revision	Unit revision is displayed in the format of "MajRev. MinRev".
	Connection setting	Select a cell, and the "Connection Setting" dialog box is displayed after clicking (...). button is displayed on the toolbar. For connection setting, see "Connection Settings", page 5-31.
	Reserved adapter *1	Set up the unit as reserved adapter or not (EtherNet/IP Device reserved) Yes: reserved as adapter. No: not reserved as adapter. (Default value)
	Cyclic (I/O) messages error	During cyclic (I/O) messages with the unit, set up it as unit error or not in case of communication error. As unit error: In case of cyclic (I/O) messages error, it is taken as a unit error (continue to execute cyclic (I/O) messages with other unit). (Default value) Not as unit error: Even if cyclic (I/O) messages error occurs, it is not taken as an unit error, but continue to execute cyclic (I/O) messages with other units. "Cyclic (I/O) messages error", page A-8

*1 If it is slot unit, it will not be displayed.

*2 If it is not a scanner or adapter of rack configuration unit, they will not be displayed.

*3 If it is a communication adapter of rack configuration unit, it will not be displayed.

"Search Unit" Tab

With the "Search Unit" tab, you can search EtherNet/IP Devices connected to the EtherNet/IP Unit. The searched EtherNet/IP Device is displayed in the "Search Unit" tab, through the same operation as in the "Search Unit" tab, and it can be registered to the scan list.

Setting procedure for creating scan list after searching EtherNet/IP Device

EDS file is required to be registered in advance.

Search EtherNet/IP Device.

"Search Unit", page 5-26

Search EtherNet/IP Device through the "Search Unit" tab.

Set up/change IP address of EtherNet/IP Device.

"Set up/change IP address", page 5-27

Set up/change IP address of EtherNet/IP Device from the "Search Unit" tab.

Point

Use the "Search Unit" tab to set up IP address for EtherNet/IP Device with initial setting of "BOOTP Startup" in IP address.

Register unit from the "Search Unit" tab to scan list.

"Register from "Search Unit" tab to scan list", page 5-29

EDS file can be registered by dragging and dropping it directly from the "Search Unit" tab.

Default setting for communication and device assignment can be executed automatically when registering EDS file.

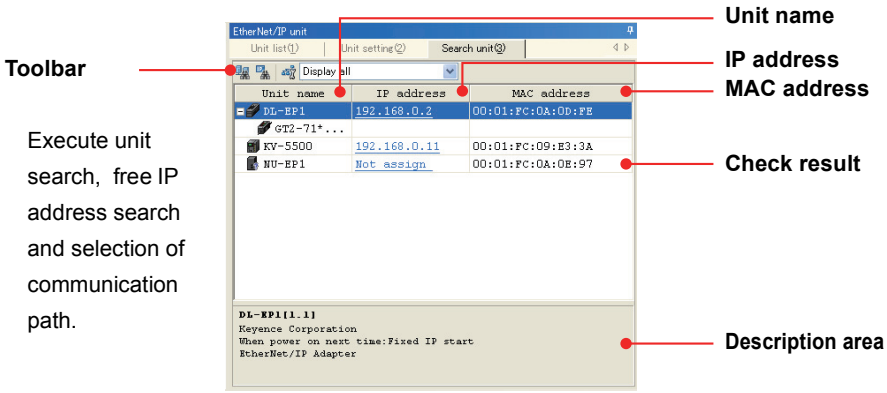
Setting of scan list end

Reference

BOOTP startup is one of the IP setting methods recommended for EtherNet/IP. For the EtherNet/IP Device with BOOTP startup, its IP address can be set up from "KV STDUIO" or "EtherNet/IP Setting".

Name and function of the "Search unit" tab

View (V) ▶ Unit Setting(3) Alt + 3



Display item	Description
Unit name	Display name of the searched EtherNet/IP Device.
IP address	Display IP address of the searched EtherNet/IP Device. If the unit with BOOTP startup is found, the IP address is displayed as unassigned.
MAC address	Display MAC address of the EtherNet/IP Device searched.
Description area	Display unit name, vendor name and file comments of the EtherNet/IP Device searched.

Point

If the EtherNet/IP Device searched is not registered to the "Unit List" tab, the unit will be treated as "Unknown EtherNet/IP Device".
After the EDS file of target EtherNet/IP Device is registered to "EtherNet/IP Setting", it will be displayed correctly. If the EDS file registered in "EtherNet/IP Setting" is different, it will be displayed as "Error EtherNet/IP Device".

Toolbar list of the "Search Unit" tab

Toolbar list

Item	Icon	Description	See page
Search Unit		Search Unit in the connected network.	5-26
Search Free IP Address.		Search IP address unused through the "Search Free IP Address" dialog box.	5-29
Select communication path		Select the path for executing unit search through the "Select Connection Destination" dialog box.	5-30

Search Unit

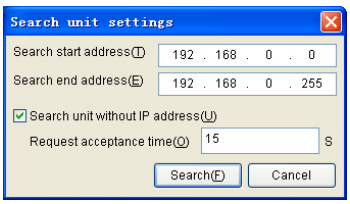
The following describes how to search unit.

Through unit search, you can search EtherNet/IP Device connected to the Ethernet and the unit with BOOTP startup.

1 Click icon on the toolbar.

The "Unit Search Setting" dialog box is displayed.

Other procedure Select "Search Unit" from the right-click menu.



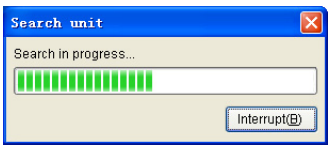
Item	Description
Search start IP address	Input IP address range needs to be searched. A maximum of 10,000 IP addresses can be searched at one time.
Search end IP address	
Search unit without IP address	If checked, unit with its IP address set up as BOOTP startup will be searched.
Request acceptance time	Set up timeout value for unit search. After sending command, the contents of units receiving response within request accept time is displayed in the search result.
"Search"	Start search.

2 Specify IP address range for search, and click "Search" button.

The "Search Unit" dialog box is displayed.

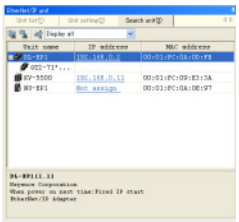
When clicking "Interrupt" button, search is aborted.

The units searched will be displayed in the "Search Unit" tab.



3 **The search result is displayed in the "Search Unit(3)" tab.**

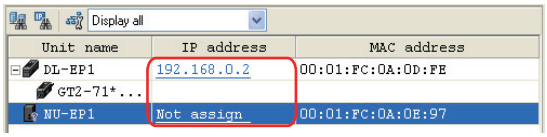
Like the "Unit List" tab, the unit searched can be registered to the scan list by dragging and dropping or selecting "Add to Scan List" from the right-click menu.



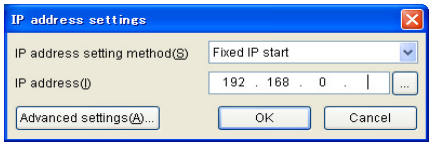
Set up/change IP address

The following describes how to set up/change the IP address of unit searched.
You can also set up the assigned IP address of unit with BOOTP startup.

1 **Click the IP address of the unit searched.**



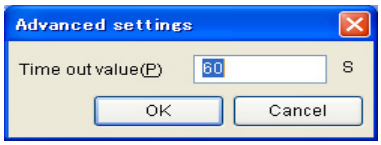
(Other procedure) Select unit and select "IP Address Setting" from the right-click menu.
The "IP Address Setting" dialog box is displayed.



Item	Description
IP address setting method*	Specify IP address setting method of the unit for next startup. Fixed IP startup : next time start up with the IP address specified this time. BOOTP startup : next time start up by BOOTP startup. After starting up, it is required to set up IP address.
IP address	Input IP address needs to be set up/changed. If IP address is changed, then the IP address will be displayed (set up).
"Advanced setting"	"Advanced setting" dialog box appears.
"OK"	Set up/change IP address.

* For IP address setting method of the unit searched, when DHCP startup is optional, "DHCP Startup" can be selected.

● **Advanced setting**



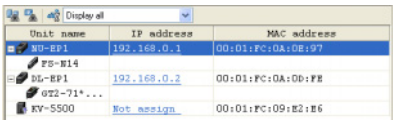
Item	Description
Timeout value	When communicating with units with BOOTP startup/DHCP startup, set up timeout value. Setting time: 15 to 300s default value: 60s
"OK"	Finish advanced setting.

2 **Input IP address, click "OK" button.**

Point

Under RUN mode, the KV-EP21V, KV-5500 or KV-NC1EP IP address cannot be changed. When executing IP address setting, switch CPU unit to PROG mode, and then set up/change the IP address.

3 **If IP address of the unit has been set up, update it to IP address of the "Search Unit" tab.**

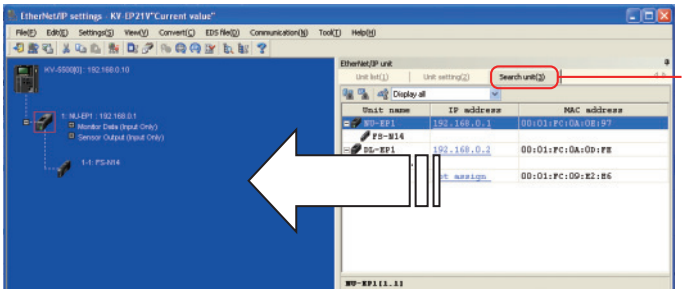


Reference

BOOTP startup is one of the IP address setting methods recommended for EtherNet/IP. The EtherNet/IP Device with BOOTP startup will send BOOTP data packets to the network regularly. "EtherNet/IP Setting" receives BOOTP data packets, and can set up/change IP address of the EtherNet/IP Device detected.

Register from "Search Unit" tab to scan list

Like "Unit List" tab, the unit searched in “search unit" tab can be registered to the scan list by dragging and dropping or selecting "Add to Scan List" from the right-click menu.



For details on registering EtherNet/IP Device to the scan list,

See "Register Unit to Scan List", page 5-12.

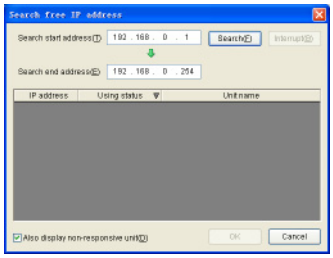
Search Free IP Address

The dialog box enables to search IP address used in network.

1 Click icon on the toolbar.

Display "Search Free IP Address" dialog box.

Other procedure
- Click "Search Free IP Address" from the right-click menu.
- Click the button of "IP Address Setting" dialog box.



Item	Description
Search start address	To enter IP address range to be searched. A maximum of 10,000 IP addresses can be searched at one time.
Search end address	
IP address	To display IP address.
Using status	To display the response status when searching IP address. In use: IP address with response when performing search. No response: IP address without response when performing search.
Unit name	To display EtherNet/IP Device name. “Unknown” is displayed for other units.
"Search"	To start search.
"Interrupt"	To interrupt search.
Also display non-responsive unit	If checked, the IP address without response is also displayed.

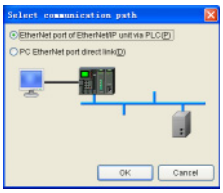
Point

Ping (echo request of ICMP) is used to search free IP address. The unit without response to ping can not be searched correctly.

How to select communication path

1 Click icon on the toolbar.

Select the communication path between PC and EtherNet/IP Device when searching unit search.

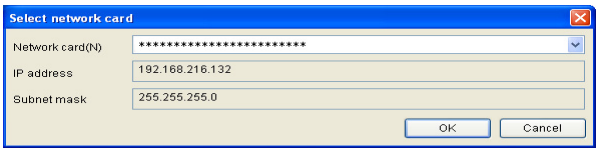


2 Select communication path, and click "Next" button.

Item	Description
Ethernet port of EtherNet/IP Device via PLC	PC communicates with the EtherNet/IP Device via the EtherNet/IP Unit.
PC EtheNet port direct link	PC communicates directly with EtherNet/IP Device.

● In case "PC EtheNet port direct link" is selected

Select the desired PC network card.



Item	Description
Network card	To display the network card used in PC.
IP address	To display IP address.
Subnet mask	To display subnet mask.

5-6 Setting

This section describes all functions included in "Setting(S)" menu and settings related to cyclic (I/O) messages.

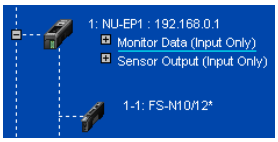
Connection Settings

Setting(S) ▶ Connection Setting(C)

Connection setting is used for setting up cyclic (I/O) messages of target EtherNet/IP Device (adapter or scanner) registered in the EtherNet/IP Unit and the scan list.
The following describes the methods of connection setting.

■ Display and overview of "Connection Setting" dialog box

The following describes how to display connection setting.
"Connection Setting" dialog box will be displayed by clicking the connection name of target unit (adapter or scanner) in the scan list.



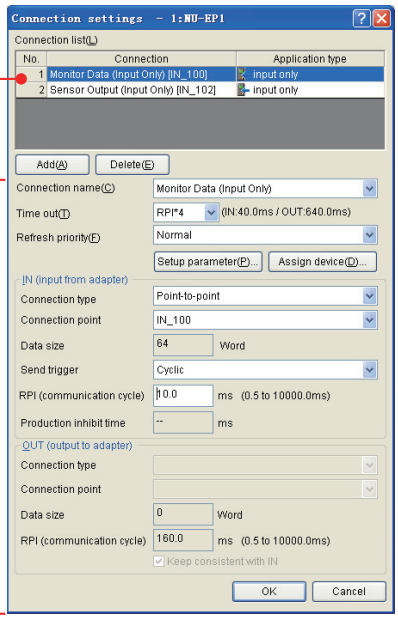
Other procedure
- Select EtherNet/IP Device in the scan list, and click "Connection Setting" on the toolbar of the" Unit Setting" tab.
- Select EtherNet/IP Device in the scan list, and click "Connection Setting" in the right-click menu.
- Select EtherNet/IP Device in the scan list, and select "Connection Setting" from the setting items of the "Unit Setting" tab.

Connection list

Display connection name and application type of the setting.

Connection Details

Display the details of connection selected in the connection list. Set value can be changed as required.



For details on setting items of the connection setting, see "Connection list", page 4-28.

Tag Settings

Setting(S) ▶ Tag setting(T)

When the EtherNet/IP Unit sends data to other scanners, tag setting specifying the connection destination from other scanners is required. The following describes how to display EtherNet/IP Unit Tag setting.

■ Display and overview of "Tag Settings" dialog box

The following describes how to display "Tag Setting" dialog box.
Click the unit name of the originator EtherNet/IP Unit in the scan list, to display the "Tag Setting" dialog box.

Other procedure



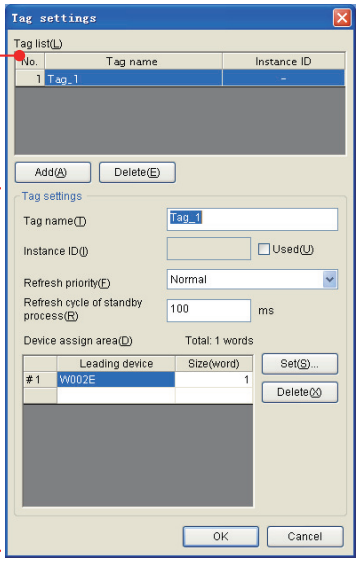
- Select EtherNet/IP Unit in the scan list, and select "Tag Settings" from the right-click menu.
- Select EtherNet/IP Unit in the scan list, and select "Tag Settings" on the toolbar of the "Unit Settings" tab.
- Select EtherNet/IP Unit in the scan list, and click "Tag Settings" from the setting items of the "Unit Setting" tab.

Tag List

Display Tag Setting list of the current setting.

Tag setting

Execute communication setting and device assignment for the Tag Setting selected.



For details on setting items of the tag setting, see "Items of tag setting", page 4-40.

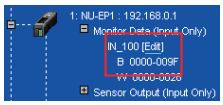
Device Assignment Settings

Assignment of sent/received communication data in cyclic (I/O) messages to CPU device can be executed in "Device Assignment Setting" dialog box of Connection Setting.
The following describes how to use "Device Assignment Setting" dialog box.

■ Display and overview of "Device Assignment Setting" dialog box

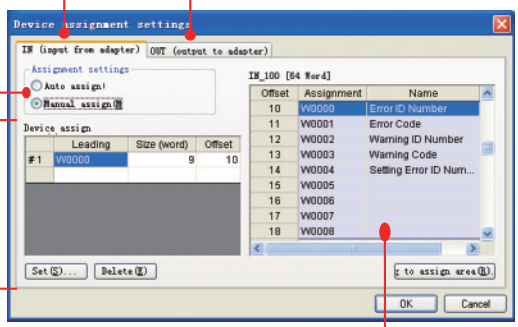
The following describes how to display device assignment setting.
"Device Assignment Setting" dialog box is displayed by clicking "Edit" of target unit (adapter or scanner) in the scan list.

Other procedure Click "Device Assignment" button in "Connection Setting" dialog box.



IN (input from the adapter) tab
Used for assigning data in receive direction.

OUT (output to the adapter) tab
Used for assigning data in send direction.



Assignment settings
Select assignment method of device.

Device assign area
Input device to be assigned. A maximum of 8 areas can be assigned, and the device can be R, B, DM, and W.

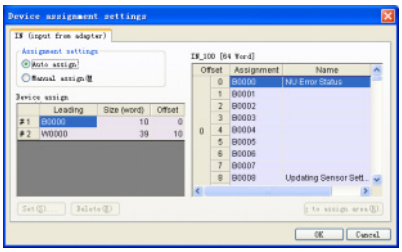
Communication data area
Data sent and received in cyclic (I/O) messages. Only a part of area can be assigned.
The background of the area with assigned device is displayed in purple.

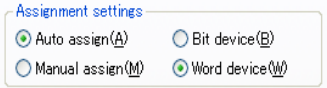
For how to change/add device assignment, see "How to change/add device assignment", page 4-45.

■ Item list of "Device Assignment Settings" dialog box

● IN (input from adapter) tab

Here, IN (input from adapter) tab is used to make a description, items of the OUT (output to adapter) tab are the same.



Item	Description
Assignment setting	
Auto assign Manual assign	To set up if assigning device automatically. In case of manual assignment, device is assigned in the device assignment area. Auto assignment: assign device automatically. Manual assignment: assign device manually. **Point** **If manual assignment is set up in the device assignment area, after selecting "Auto assignment", device assignment will be reexecuted.**
Bit device Word device	It is displayed in case of EtherNet/IP Device to which communication data type is not defined . You can select device under auto assignment from bit device and word device. 
Device assign area (can be set up under manual assignment)	
Leading device	Input leading device (even) assigned to different areas. The available devices are R, B, DM, and W. When using R and B, it is required to specify CH leading No. of relay. As input, "Area Setting" dialog box is displayed.
Size (word)	Input data size assigned to different areas in word. Data started from the offset position is assigned to the devices starting from leading device according to the specified size. Total number of devices in communication data areas can not excess the number of devices assigned in area 1 to 8. As input, "Area Setting" dialog box is displayed.
Offset	Specify offset position of communication data area, to which leading devices for different areas are assigned. As input, "Area Setting" dialog box is displayed.
"Set"	"Area Setting" dialog box is displayed.
"Delete"	Delete device assignment area selected.
(Cyclic (I/O) messages data area)	
Offset	Display offset position started from leading position of cyclic (I/O) messages data.
Assigned device	Display device assigned in cyclic (I/O) messages data. The background of the area with assigned device is displayed in purple.
Name	Display name of the cyclic (I/O) messages data.
"Reg to Assignment Area".	Register cyclic (I/O) messages data selected to device assignment area. Display "Area Setting" dialog box in which offset position and size (word) of cyclic (I/O) messages data are entered.

Setup Backup Sensor Settings

Setting(S) ► Setup backup sensor settings(B)

"Setup backup sensor settings" is displayed, when selecting "Setting(S)" ► "Setup backup sensor settings(B)" from the menu

Other procedure
- Select EtherNet/IP Unit from the scan list, and click toolbar in the "Unit Setting" tab, or click "Setup backup sensor settings".
- In the KV STUDIO workspace, click "Sensor application"->"Setup backup sensor settings" in the right-click menu of the EtherNet/IP Unit.

For setup backup sensor settings, See "Setup backup sensor settings", page 7-12.

Setup Batch Transmission Sensor Settings

Setting(S) ► Setup batch transmission sensor settings(S)

"Setup batch transmission sensor settings" dialog box is displayed when selecting "Setting(S)" ► "Setup batch transmission sensor settings(S)" from the menu.

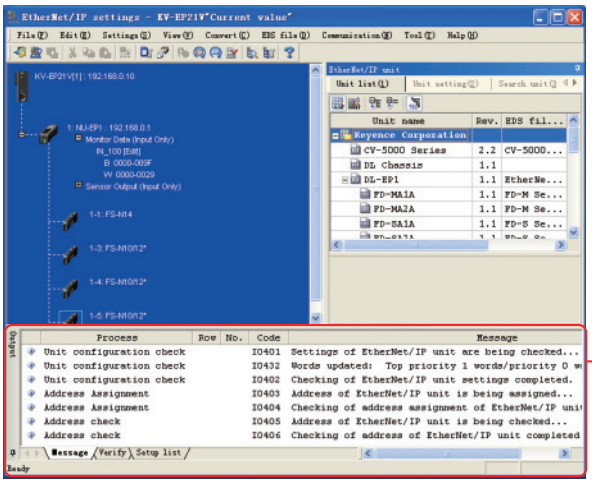
Other procedure
- Select EtherNet/IP Unit from the scan list, and click toolbar in the "Unit Setting" tab, or click "Setup batch transmission sensor settings".
- In the KV STUDIO workspace, click "Sensor application"->"Setup batch transmission sensor settings" in the right-click menu of the EtherNet/IP Unit.

For setup batch transmission sensor settings, See "Setup batch transmission sensor settings", page 7-51.

5-7 Output Window

This section describes what is displayed in output window.

Overview of Output Window



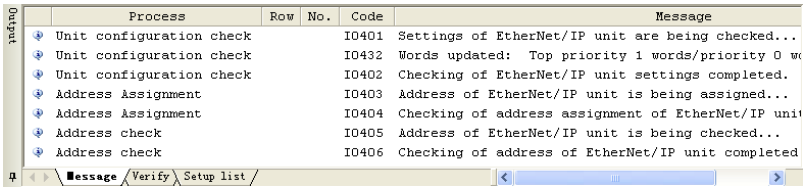
Output window

- "Message" tab
- "Verify" tab
- "Setup List" tab

"Message" Tab

Setting check result will be displayed in "Message" tab.

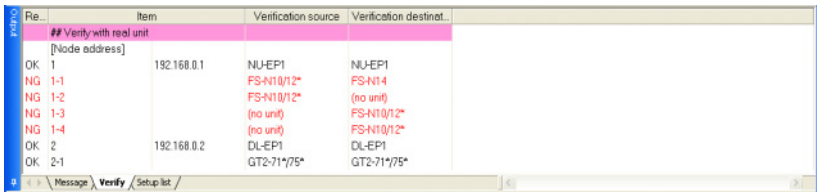
In case of error, scan list cursor will move to EtherNet/IP Device where error is found by double-clicking message line.



For the setting check, see "Setting Check", page 5-52.

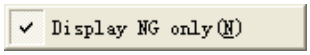
"Verify" Tab

"Verify" tab displays verification result between setting data of EtherNet/IP Setting and a real machine. If there is any EtherNet/IP Device with verification error, scan list cursor will move to the target EtherNet/IP Device after double clicking message line.



● Display NG only

For verification result display, if "Display NG only" in right-click menu is selected, only NG result will be displayed.



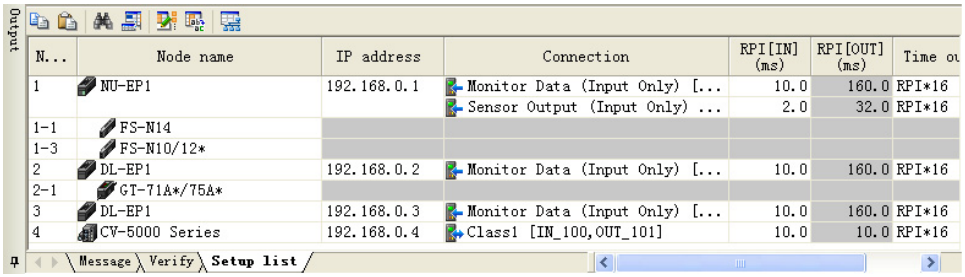
For verification with a real machine, see "Verify with Real Machine", page 5-53.

"Setup List" Tab

View (V) ▶ Setup List(6) Alt + 6

"Setting list" tab displays node address, node name and IP address of EtherNet/IP Device registered in scan list, as well as connection setting in a list. In "Setting list" tab, you may batch input/replace setting of each EtherNet/IP Device.

By selecting "View(V)" ▶ "Setup list (6)" from menu, "Setup list" tab of output window is displayed.



Item	Description
Node	Display node address. For slot unit, slot No. will be displayed after node address.
Node name	Display node name and slot name. Node name and slot name can be changed.
IP address	Display IP address. IP address may be changed.
Connection name	Display connection name of setting. After selecting it and clicking [...] button, "Connection setting" dialog box will be displayed.
RPI [IN](ms)*	Display RPI (communication period) from EtherNet/IP Device will be displayed; RPI can also be changed.
RPI [OUT](ms)*	Display RPI (communication period) from the EtherNet/IP Unit to the EtherNet/IP Device. RPI can also be changed.
Time out *	Display timeout. Time out can also be changed.
Update priority *	Display refresh priority. Refresh priority can also be changed.

* For details on setting items, see "Connection list", page 4-28.

Toolbar list

With toolbar in "Setup list" tab, the following operations can be performed.

Item	Icon	Description
Copy		Copy selected range.
Paste		Paste what is copied at cursor position.
Search		Display "Search" dialog box.
Skip to scan list		Move scan list cursor to selected EtherNet/IP Device on "Setting list" tab.
Batch input		Display "Batch input" dialog box.
Batch replacement		Display "Batch replacement" dialog box.
Calculate cyclic (I/O) messages load factor		Display "Calculate cyclic (I/O) messages load factor" dialog box.

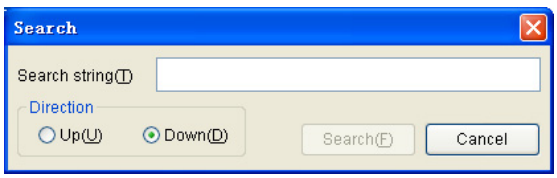
Copy/Paste

/

Clicking / button or select "Copy"/"Paste" from right-click menu to copy/paste the content of selected range. When you copy and paste selected multiple lines, multiple lines will be pasted from specified line.

Search

Click button or select "Find" from right-click menu to display "Find" dialog box.
On "Setting list" tab, enter character string to be searched.



Setting item		Description
Search string		Enter character string to be searched Setting range: <= 32 full-width characters
Direction	Up	Find from the current cursor position upwards.
	Down	Find from the current cursor position downwards.
"Search"		Find a specified character string.
"Cancel"		Close "Search" dialog box.

Skip to scan list

On "Setup list" tab, after selecting EtherNet/IP Device and clicking button, or selecting "Skip to scan list" from right-click menu, cursor will move to the unit in scan list area.

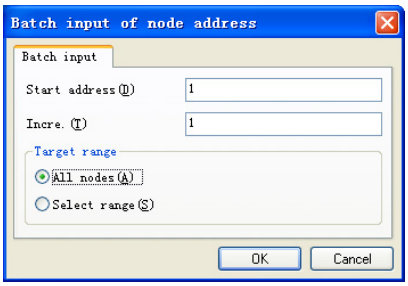
batch input/replacement /

You may batch input/replace to items in selected range or all ranges.
After you select item to be changed and range, and click / button, or select "Batch input"/"Batch replacement" from right-click menu, "Batch input"/"Batch replacement" dialog box for the selected item will be displayed.
Different content will be displayed depending on selected items.

■ Batch input of node address

● Batch input of node address

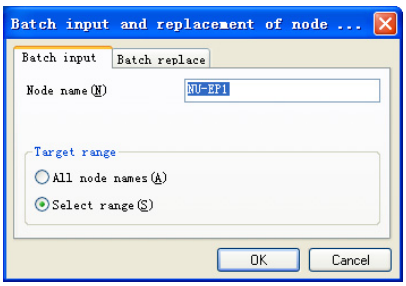
Item		Description
Start address		Input leading node address.
Increment		Enter increment of node address. Enter node address from top to bottom within target range as per increment.
Target range	All nodes	Select nodes in target range from "All"/ "Selected range".
	Setting range	
"OK"		Execute batch input as per set value.



■ Batch input and replacement of node name

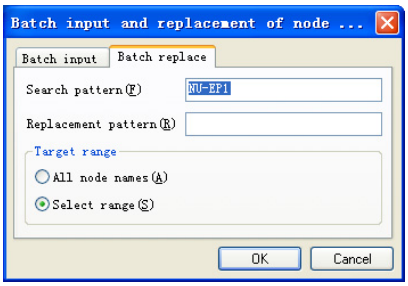
● Batch input and replacement (batch input) of node name

Item		Description
Node name		Input node name. Setting range: <= 16 full-width characters
Target range	All node name	Select target range from "All node names"/"Selected range".
	Select range	
"OK"		Execute batch input as per set value.



● Batch input and replacement (batch replacement) of node name

Item		Description
Search pattern		Enter node name before replacement.
Replacement pattern		Enter node name after replacement. Setting range: <= 16 full-width characters
Target range	All node name	Select target range from "All node names"/"Selected range".
	Select range	
"OK"		Execute batch replacement as per set value.



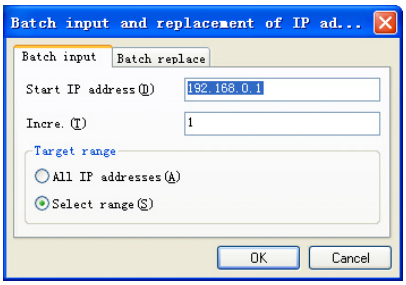
■ Batch input and batch replacement of IP address

The following IP addresses cannot be used.

- The same IP address as the EtherNet/IP Unit
- IP address included in 0. 0. 0. 0,127. 0. 0. 0 to 127. 255. 255. 255, 224. 0. 0. 0 to 255. 255. 255. 255

● Batch input and replacement (batch input) of IP address

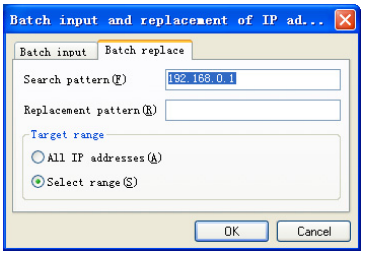
Item		Description
Start IP address		Input start IP address.
Increment		Enter increment at end of IP address. Add from top to bottom end of each start IP address, and enter IP address within target range. *
Target range	All IP addresses	Select target range from "All IP addresses"/"Selected range".
	Select range	
"OK"		Execute batch input as per set value.



* Once end of IP address exceeds 255, return to 0 before new address is added.
Example) Start IP address: 192. 168. 0. 250, increment:10
Entered result is Unit 1: 192. 168. 0. 250, Unit 2: 192. 168. 0. 4, Unit 3: 192. 168. 0. 14.

● Batch input and replacement (batch replacement) of IP address

Item		Description
Search pattern		Enter IP address before replacement.
Replacement pattern		Enter IP address after replacement.
Target range	All IP addresses	Select target range from "All IP addresses"/"Selected range".
	Select range	
"OK"		Execute batch replacement as per set value.



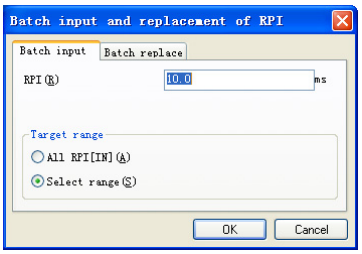
■ Batch input and batch replacement of RPI [IN]

Point

After PI [IN] is changed, timeout setting will also be changed when timeout value is less than 10ms, so that timeout value exceeds 10ms.

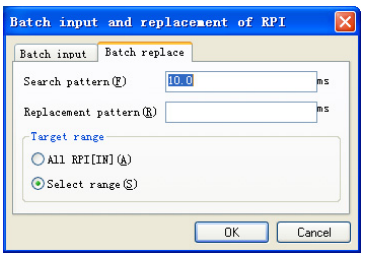
● Batch input and replacement (batch input) of RPI [IN]

Item		Description
RPI		Input RPI[IN]. Setting range: 0. 5 to 10000. 0ms Unit: 0. 5ms
Target range	All RPI[IN]	Select target range from "All RPI [IN]"/ "Selected range"
	Select range	
"OK"		Execute batch input as per set value.



● Batch input and replacement (batch replacement) of RPI [IN]

Item		Description
Search pattern		Enter RPI [IN] before replacement.
Replacement pattern		Enter RPI [IN] after replacement. Setting range: 0. 5 to 10000. 0ms Unit: 0. 5ms
Target range	All RPI [IN]	Select target range from "All RPI [IN]"/ "Selected range"
	Select range	
"OK"		Execute batch replacement as per set value.

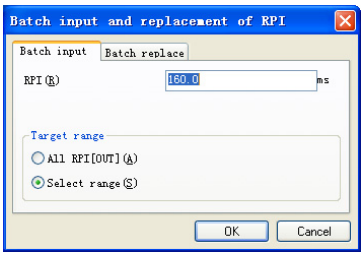


■ Batch input and batch replacement of RPI [OUT]

Point

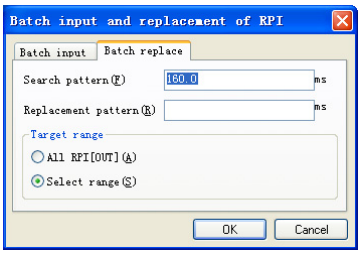
After RPI [OUT] is changed, timeout setting will also be changed when timeout value is less than 10ms, so that timeout value exceeds 10ms.

● Batch input and replacement (batch input) of RPI [OUT]



Item		Description
RPI		Input RPI[OUT]. Setting range: 0. 5 to 10000. 0ms Unit: 0. 5ms
Target range	All RPI [OUT]	Select target range from "All RPI [OUT]"/"Selected range".
	Select range	
"OK"		Execute batch input as per set value.

● Batch input and replacement (batch replacement) of RPI [OUT]



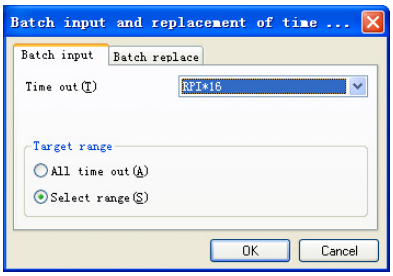
Item		Description
Search pattern		Enter RPI [OUT] before replacement.
Replacement pattern		Enter RPI [OUT] after replacement. Setting range: 0. 5 to 10000. 0ms Unit: 0. 5ms
Object range	All RPI [OUT]	Select target range from "All RPI [OUT]"/"Selected range".
	Select range	
"OK"		Execute batch replacement as per set value.

■ Batch input and batch replacement of timeout

Point

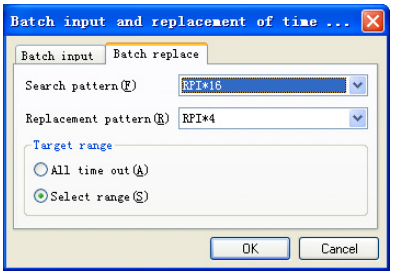
Time out value must be above 10ms. At batch input, timeout that is set to be less than 10ms will not be changed.

● Batch input and replacement (batch input) of timeout



Item		Description
Timeout		Enter timeout. Setting range: RPIx4/RPIx8/RPIx16/RPIx32/ RPIx64/RPIx128/RPIx256/RPIx512
Target range	All timeout	Select target range from "All timeout"/ "Selected range".
	Select range	
"OK"		Execute batch input as per set value.

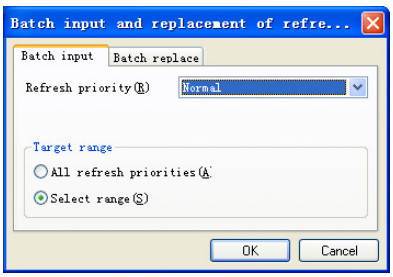
● Batch input and replacement (batch replacement) of timeout



Item		Description
Search pattern		Enter timeout before replacement.
Replacement pattern		Enter timeout after replacement. Setting range: RPIx4/RPIx8/RPIx16/RPIx32/ RPIx64/RPIx128/RPIx256/RPIx512
Target range	All timeout	Select target range from "All timeout"/ "Selected range".
	Select range	
"OK"		Execute batch replacement as per set value.

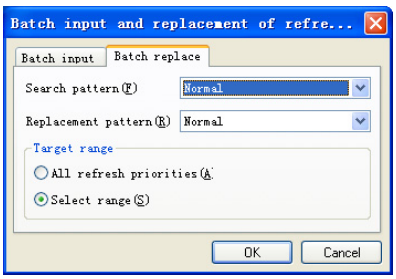
■ Batch input and batch replacement of refresh priority

● Batch input and batch replacement (batch input) of refresh priority



Item		Description
Refresh priority		Enter refresh priority. Setting range: Normal/Priority/Top priority (each scanning)
Target range	All refresh priority	Select target range from "All refresh priority"/"Selected range".
	Setting range	
"OK"		Execute batch input as per set value.

● Batch input and batch replacement (batch replacement) of refresh priority



Item		Description
Search pattern		Enter refresh priority before replacement.
Replacement pattern		Enter refresh priority after replacement. Setting range: Normal/Priority/Top priority (each scanning)
Target range	All refresh priorities	Select target range from "All refresh priority"/"Selected range".
	Select range	
"OK"		Execute batch replacement as per set value.

Calculate cyclic (I/O) messages load factor



When you click  button or select "Calculate cyclic (I/O) messages load factor" from right-click menu, "Calculate cyclic (I/O) messages load factor" dialog box will be displayed.

For "Calculate cyclic (I/O) messages load factor" dialog box, see "5-13 Calculate Cyclic (I/O) Messages Load Factor", page 5-67.

5-8 File

Describe all functions included in "File(F)" menu.

Import

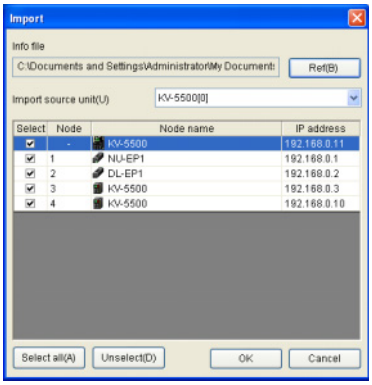
File(F) ▶ Import(I) Ctrl + K

Reads EtherNet/IP Device's setting information file created in other projects, and add it to scan list.

1 Select "File(F)" ▶ "Import(I)" from the menu.

"Import" dialog box is displayed .

2 Specify file position when importing unit setting information file.



Item	Description
Information file	Display where a file is saved when importing unit setting information file. You may select unit setting information file in "Open file" dialog box after clicking "Reference" button.
Import source unit	Add a unit No. to the end of the unit name of the EtherNet/IP Unit set in imported file and display. Read unit setting information of displayed unit.
Select	EtherNet/IP Device with check box checked will be import object.
Node	Display node address, node name and IP address of the EtherNet/IP Device registered in scan list.
Node name	
IP address	
"Select all"	Select all of the EtherNet/IP Devices.
(Unselect)	"Unselect all"

3 **Select EtherNet/IP Device to be imported and click "OK" button.**

Unit setting information and unit comments will be imported.

Point

- **Tag setting will be imported when importing originator unit (EtherNet/IP Unit). The imported tag setting will be added to the end of the import destination unit (EtherNet/IP Unit) tag setting. Tag setting will not be imported when the total number of tag settings and connection settings after import exceeds 256 (64 for KV-NC1EP).**
- **If node address and IP address are already used by import destination scan list, assignment will be done from minimum free No. in sequence.**
- **Backup sensor settings and batch transmission sensor settings in imported files will not be imported.**

Application

File(F) ▶ Apply(A) Ctrl + S

Applies (saves) EtherNet/IP Setting data.

Close

File(F) ▶ Close(C) Alt + F4

1 **Click "File(F)" ▶ "Close(C)" from the menu of "EtherNet/IP Setting" to exit.**

(Other procedure) Click on the right of titlebar of EtherNet/IP Setting to exit.

5-9 Edit

This section describes various functions in "Edit(E)" menu.

Cut/Copy/Paste





Edit(E) ▶ Cut(T) Ctrl + X
▶ Copy(C) Ctrl + C
▶ Paste(P) Ctrl + V

Moves and copies EtherNet/IP Device assigned in scan list.

1 When copying unit, select "Edit(E)" ▶ "Copy(C)" from the menu to select a unit. When moving unit, select "Edit(E)" ▶ "Cut(T)" from the menu.

Other procedure This can be done from right-click menu.

Reference The moved unit will be displayed after moving.

2 Move cursor to the position where unit is to be pasted and select "Edit(E)" ▶ "Paste(P)" from the menu.

Other procedure This can be done from right-click menu.

Reference When moving unit, you may drag and drop the selected unit to target position .

Point

The following are settings after copying/pasting unit.

Node address : Node address will be assigned after adding unit to scan list. Such node address is the node address set up in "Default setting" dialog box, or the next number of node address assigned to pasted unit.

IP address : Node address will be assigned after adding unit to scan list. Such IP address is the IP address set up in "Default setting" dialog box, or the next number of node address assigned to pasted unit.

Slot No. : When pasting slot unit on communication adapter, minimum free slot No. will be assigned.

Device : Same device assignment will be copied. Execute device assignment after pasting.

Delete

Edit(E) ▶ Delete(D) Delete

Select the unit to be deleted from scan list, and select "Edit(E)" ▶ "Delete(D)" from the menu or select "Delete" from the right-click menu.

Scan list

Select all

Edit(E) ▶ Scan list(S) ▶ Select all(A) Ctrl + A

Select from menu "Edit(E)" ▶ "Scan list" ▶ "Select all(A)", or select "Select all" from right-click menu, and select all target units excluding the unit.

Scan list sorting

Edit(E) ▶ Scan list(S) ▶ Node address ascending(N)
▶ Node address descending(O)
▶ IP address ascending(I)
▶ IP address descending(D)

Re-arrange EtherNet/IP Devices registered in scan list by node address and IP address.

Reserve/unreserve EtherNet/IP Device

 **Edit(E) ▶ Scan list(S) ▶ EtherNet/IP Device reserve(B)** Ctrl + R

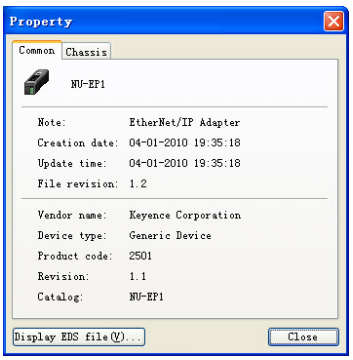
To select EtherNet/IP Device to be reserved, select the scan list and select "Edit(E)" ▶ "Scan list(S)" ▶ "EtherNet/IP Device reserve(B)" from the menu, or select "EtherNet/IP Device reserve" from the right-click menu.

- If there is an EtherNet/IP Device scheduled to be added in the future, or unit using same Ladder and to be installed or uninstalled by unit type, you may set up the unit to be "EtherNet/IP Device reserve" as dummy unit. Even "EtherNet/IP Device reserve" is set, the setting information of such unit will still be transferred to CPU.
- To cancel reserved EtherNet/IP Device, select the reserved unit and select "Edit(E)" ▶ "Scan list(S)" ▶ "EtherNet/IP Device unreserve(B)" from the menu, or select "EtherNet/IP Device unreserve" from the right-click menu.

Property of EtherNet/IP Device

Edit(E) ▶ Scan list(S) ▶ Property(P)

Select the EtherNet/IP Device registered in scan list, and select "Edit(E)" ▶ "Scan list(S)" ▶ "Property(P)", or click "Property" in the right-click menu to display EtherNet/IP Device (ED0 file) property.



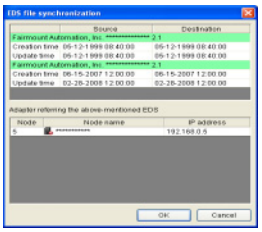
● EDS file synchronization

EDS file information of EtherNet/IP Device displayed as error will be replaced with the EDS file information of EtherNet/IP Device registered on "Unit list" tab.

Only when error EtherNet/IP Device is selected, "EDS file synchronization" button will be displayed in "Property" dialog box.

Click "EDS file synchronization" button to display "EDS file synchronization" dialog box.

For error EtherNet/IP Device, see "Display of EtherNet/IP Device", page 5-11.



Item		Description
"Unit name"		Display unit name, vendor name and revision of the EtherNet/IP Device.
Creation time / Update time	Synchronization source	Display creation and update time of EDS file used by EtherNet/IP Device selected in scan list.
	Synchronization destination	Display creation and update time of EDS file registered in "Unit list" tab.
Adapter referencing above-mentioned EDS		Display EtherNet/IP Device registered in scan list using EDS file with same unit name.
Node		Display node address, node name, and IP address of the EtherNet/IP Device.
Node name		
IP address		
"OK"		EDS file of selected EtherNet/IP Device and EtherNet/IP Device displayed in adapter referencing above-mentioned EDS will be replaced with EDS file registered in EtherNet/IP Device of "Unit list" tab.
"Cancel"		Will not execute synchronization and exit.

Point

For the EtherNet/IP Device registered in scan list, error may not be removed even by executing EDS file synchronization due to different connection settings.

5-10 Convert

This section describes various functions in "Convert(C)" menu are described.

Jump to Error Rung

Convert(C) ▶ Jump to error rung(E) F4

When you select "Convert(C)" ▶ "Jump to error rung(E)" from the menu, or press Enter, error selected on "Message" tab in output window will move to next error line, and scan list cursor will move to the EtherNet/IP Device related to such error.

All Unit Auto Assignment

Convert(C) ▶ All assign auto units(A) F5

Select from menu "Convert(P)" ▶ "All assign auto units(A)".
Relays/DMs and devices for all units (including the EtherNet/IP Unit) and devices for EtherNet/IP Unit cyclic (I/O) messages will be assigned automatically at the same time.
You may use option setting of Unit Editor of KV STUDIO to set up leading No. of relay/DM used by units. EtherNet/IP Devices registered in the EtherNet/IP Unit scan list, and their cyclic (I/O) message devices are automatically assigned in the scan list configuration order.
Leading No. of device assigned for cyclic (I/O) messages device is "assigned bit device leading No. " and "assigned word device leading No. " of Unit Editor. When "Automatic assignment setting" is enabled, next No. is automatically assigned as per B (bit) and W (word) used by other EtherNet/IP Devices connected to the left of the EtherNet/IP Unit.

Other procedure Select "Convert(P)" ▶ "Relay/DM auto assignment(A)" from the menu of Unit Editor of KV STUDIO, or press F5 button.

For rules on auto relay/DM assignment to unit, see KV STUDIO Userís Manual.

Auto assignment within unit

Convert(C) ▶ Auto assign in the unit(U) Shift + F5

Select "Convert(P)" ▶ "Auto assign in the unit(U)" from the menu.
Devices for cyclic (I/O) messages with EtherNet/IP Device registered in the scan list are automatically assigned by the configuration order of scan list.
Leading No. of device assigned for cyclic (I/O) messages device is "assigned bit device leading No." and "assigned word device leading No." of Unit Editor.
"EtherNet/IP Setting", page 3-11

Point

- **Devices for cyclic (I/O) messages are assigned by the configuration order of scan list. In case of assignment by node address order, auto assignment must be executed after rearrangement by node address order.**
- **After auto assignment, device No. in program remains same even if device No. assigned in cyclic (I/O) messages changes.**
- **If device assignment is set up as manual assignment, cyclic (I/O) messages device remains same even if auto assignment within unit is executed.**
- **Even if "auto assignment setting" is disabled, when other EtherNet/IP Devices connected on the left are used for cyclic (I/O) messages, "assigned bit device leading No." and "assigned word device leading No." will be assigned automatically to devices afterwards.**

Setting Check

Convert(C) ▶ Setting check(C) F6

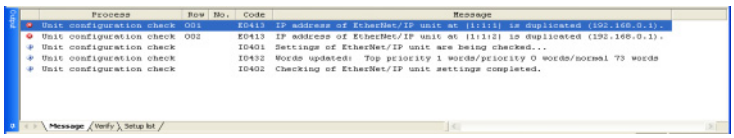
Checks whether scan list setting is correct.
Setting check will be executed automatically upon exiting EtherNet/IP Setting, and any error will be displayed in message area of Unit Editor.

1 Select "Convert(C)" ▶ "Setting check(C)" from the menu.

Start checking scan list settings, device assignment and EtherNet/IP Setting data capacity.

2 Check result will be displayed on "Message" tab of output window.

Any error will be displayed on "Message" tab of output window; correct content will be displayed if no error is found. In case of error, scan list cursor will move to the EtherNet/IP Device where error is found by double-clicking message line.



Point

The EtherNet/IP Setting data capacity is calculated during transmission as follows. If there is too much data for the capacity, decrease the amount of data.
Capacity calculation formula
Capcity (bytes) = (U x 22) + (N x 6) + (C x 14) + (A x 8)
U: Number of units
N: Total number of nodes for all units
C: Total number of connection settings in use
A: Total number of device areas assigned in connection setting
The capacity which can be used differs according to the unit.
• A maximum of 160 kB can be made for KV-EP21V and KV-5500.
• A maximum of 10kB can be made for KV-NC1EP.
Sample calculation:
No. of units: 1
Total No. of nodes: 5
Total No. of connections set: 5 (set to 1 connection per node)
Total No. of device areas: 10 (A bit area and word area is assigned to each connection device)
Capcity (bytes) = (1 x 22) + (5 x 6) + (5 x 14) + (10 x 8) = 202 (bytes)

This section describes all functions of "Communication(N)" and "Tool(T)" menus.

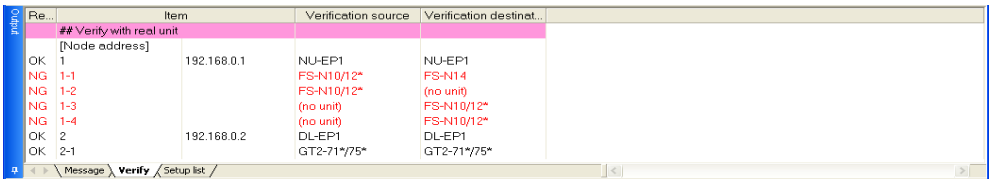
Verify with Real Machine

Communication(N) ▶ Verify real machine(C)

Verifies setting of unit connected in real network with setting of scan list.

Select "Communication(N)" ▶ "Verify real machine(C)" from the menu, and then verify the scan list with unit connected in real network.

The "Verification in process" dialog box is displayed during verification, and verification result will be displayed on "Verification" tab of output window upon completion.



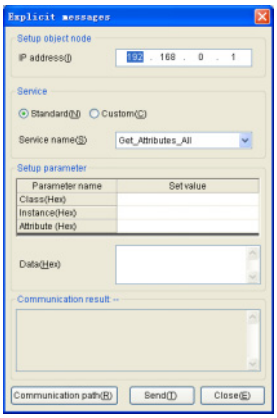
Explicit Messages

Communication(N) ▶ Explicit messages(M)

For EtherNet/IP Devices connected with EtherNet/IP Units, explicit messages send can be executed just by entering a command.
For services executed for EtherNet/IP Device, see appropriate unit manuals.

1 Select "Communication(N)" ▶ "Explicit messages(M)" from the menu.

"Explicit messages" dialog box appears.



Reference

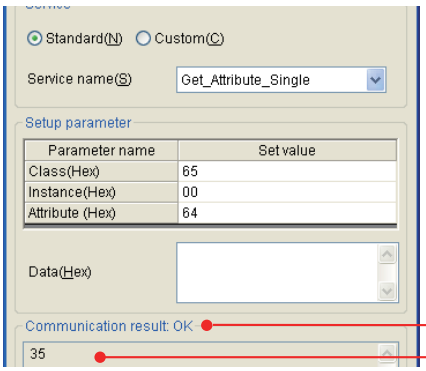
For the EtherNet/IP Device not registered in scan list yet, you may also specify IP address and then execute explicit messages send.

2 Enter target IP address and content to be sent.

Item	Description
IP address	Enter IP address of explicit messages target EtherNet/IP Device. Select a unit registered in scan list, and start up with IP address of unit entered after opening "Explicit messages" dialog box.
Standard Service name	Select service name from the drop-down list.
custom Service code	Enter service code in Hex. Setting range: 00 to 7F(H)
Class (Hex)	Select Class ID from drop-down list. Or manually enter specific unit Class ID.
Instance (Hex)	Enter Instance ID in Hex. Setting range: 0 to FFFF(H), can be omitted.
Attribute (Hex)	Enter Attribute ID in Hex. Setting range: 0 to FFFF(H), can be omitted.
Data (Hex)*	Enter data to be sent. You may enter 488-byte Hex data at most.
Communication result	Display service response data sent by EtherNet/IP Device. Clear content when sending message and display result when receiving response.
"Communication path"	Select communication path between PC and EtherNet/IP Device. In the case of "Ethernet port of EtherNet/IP unit via PLC", a message will be sent from the EtherNet/IP Unit connected with the CPU. In the case of "Direct connection to Ethernet port of PC", message will be sent directly from PC.
"Send"	Execute explicit messages send that is set up. Grayout during explicit messages.

* Number of data can not be specified as odd number (odd-numbered byte). If odd number of data is entered, sending will not be completed correctly.

● **Sending example**



Sending service example
KV-EP21V
Class ID : 65H (PLC object)
Instance : 00H
Attribute : 64H (PLC model)
Data : omitted

OK/NG
Response service data
35H(35H:KV-5500)

Transmission Adapter Settings

Communication(N) ▶ Transmission adapter settings (A)

For transmission adapter settings function, see "5-12 Transmission Adapter Settings", page 5-56.

Startup of KV DATALINK+ for EtherNet/IP

Tool(T) ▶ Start KV DATALINK+ for EtherNet/IP(D)

Starts up "KV DATALINK+ for EtherNet/IP".
For details of "KV DATALINK+ for EtherNet/IP",
See "Chapter 6 OPERATION OF KV DATALINK+ for EtherNet/IP".

Calculate Cyclic (I/O) Messages Load Factor

Tool(T) ▶ Calculate cyclic(I/O) messages load factor(C)

Displays "Calculate cyclic (I/O) messages load factor" dialog box.
For "Calculate cyclic (I/O) messages load factor" dialog box, see "5-13 Calculate Cyclic (I/O) Messages Load Factor", page 5-67.

5-12 Transmission Adapter Settings

Transmission adapter settings function is used to read/write setting of EtherNet/IP adapter registered in scan list. Transmission adapter settings function is described below.

Features of Transmission Adapter Settings Function

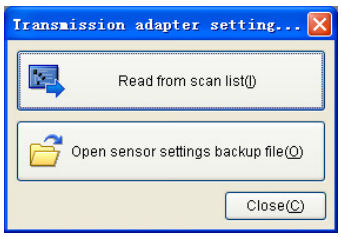
- Reads settings of EtherNet/IP adapter registered in scan list.
- Writes settings of EtherNet/IP adapters registered in scan list.
- Settings of transmission adapter settings function can be saved as backup sensor settings file.
- Settings of transmission adapter settings function can be verified with actually connected EtherNet/IP adapter or backup sensor settings file.

Startup and Exit of Transmission Adapter Settings Function

Startup

Communication(N) ▶ Transmission adapter settings (A)

Select "Communication(N)" ▶ "Transmission adapter settings (A)" from the menu and "Transmission adapter settings startup menu" dialog box will be displayed.



With "Read from scan list" or "Open backup sensor settings file", select EtherNet/IP adapters used in transmission adapter settings to start transmission adapter settings function.

" Open backup sensor settings file", page 5-61

Reference At most 2 "Transmission adapter settings" dialog boxes can be started at same time.

Result

File(F) ▶ Close(C) Alt + F4

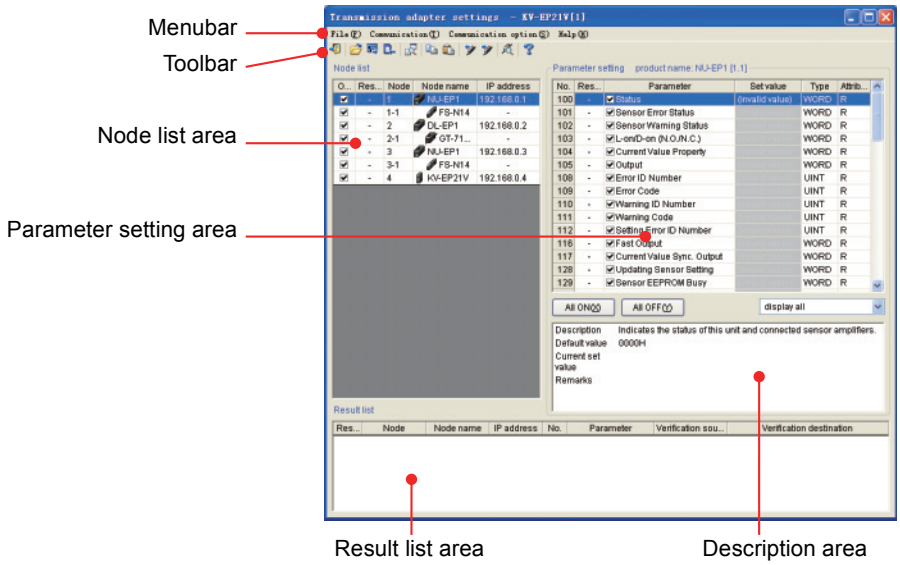
Exits from transmission adapter settings function.

1 Select "File(F)" ▶ "Close(C)" from the menu of transmission adapter settings.

Point

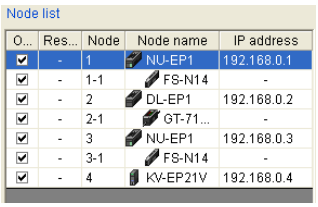
Settings will be discarded after exit. If you need to save settings, you must execute "Save backup sensor settings file" before exiting ("File(F)" ▶ "Save as backup sensor settings file(B)").

Name and Function of Each Part of Transmission Adapter Settings



Node list area

This area displays adapters used when reading/writing parameters. Selected adapter parameters will be displayed in "Parameter setting" area, and parameters of transfer target unit will become the target of transmission adapter settings.



Item	Description
Object	Checked adapters will become target of transmission adapter settings.
Result	Display (read /write /verify) results of transmission adapter settings for each adapter unit. For display content, see content of each function execution.
Node	Display node address (slot No.), node name and IP address of an adapter unit.
Node name	
IP address	

■ How to register adapter unit

There are two ways to register adapters in node list: reading from scan list or opening from backup sensor settings file.

"Read from the scan list", page 5-61

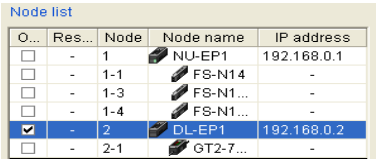
" Open backup sensor settings file", page 5-61

■ Right-click menu of node list area

Item	Description
All adapters serve as transfer Object	All adapters are set up to serve as transfer target.
All adapters do not serve as transfer object	Cancel all adapters selected as transfer target.
Re-assign	If adapter setting read from backup sensor settings file differs from the adapter setting of scan list (i. e. different node address), adapters being set up will be reassigned.

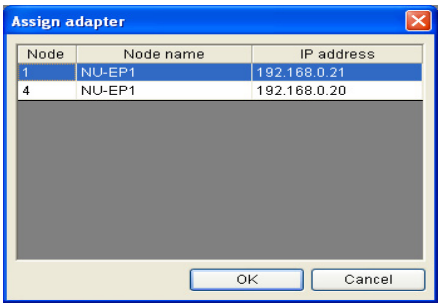
● Re-assign

If adapter setting read from backup sensor settings file differs from the unit setting in scan list (different node address), or does not exist, it will be grayed out.



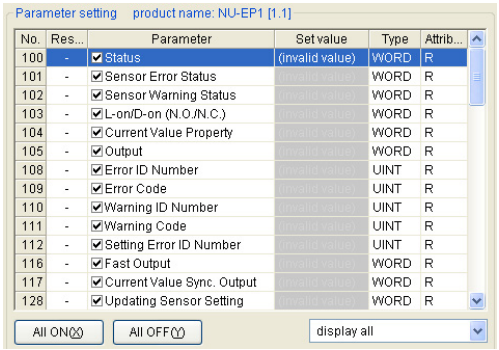
Re-assignment will be executed when executing transmission adapter settings of adapters in scan list are executed.

Select a grayed out adapter and click "Re-assign" in right-click menu. Select adapters assigned in "Adapter assignment" dialog box, and click "OK" button to execute re-assignment.



Parameter setting area

This area displays parameters of EtherNet/IP adapter unit selected in "node list" area. In "parameter setting" area, set up each individual parameter used in transmission adapter settings.



Item	Description
No.	Display parameter No. .
Result	Display (read/write /verify) result of transmission adapter settings for each parameter. For display content, see 📖 " Execution of Transmission Adapter Settings (Communication)", page 5-63.
Parameter	Display parameter name defined in adapter EDS file. Checked parameters will become the target of transmission adapter settings.
Set value	Display current value and set value of parameters.
Type	Display data type of parameters defined in EDS file.
Attribute	Display attribute of parameters defined in EDS file. R: used for reading, R/W: used for reading/writing
"All ON"	All parameters serve as the target of transmission adapter settings.
"All OFF"	Unselect all selected parameters.
display all	Display parameters as per condition. Display all : show all parameters. Only display backup object : Only display parameters as the target of backup sensor settings function. Only display OK items : Only display parameters with OK result. Only display error items : Only display parameters with error result. Only display NG items : Only display parameters with NG result. Display backup object and NG item: Only display parameters as the target of backup sensor settings function and with NG result.

● Right-click menu of parameter setting area

The following menu will be displayed after right-clicking parameters in "parameter setting" area

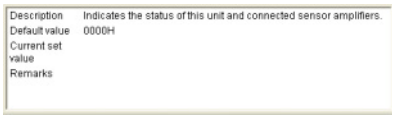
Item	Toolbar	Key	Description
Copy set values		Ctrl + C	Copy/paste set values of writing parameters in selected range.
Paste set values		Ctrl + V	
Restore to default	-	-	Restore set values of writing parameters to default value defined in EDS file.
Not check non-selected parameters	-	-	Parameters not in selected (multiple choices) range.

Point

- **Only set values of writing parameters serve as copy/paste object.**
- **Paste operation will be executed even if type of parameter selected at copying and pasting is different. For pasting, check whether set values are correct before writing.**

Description area

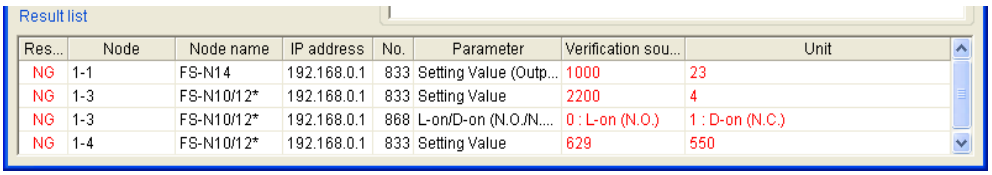
For parameters selected in "parameter setting" area, contents defined in EDS file, default value and setting range will be displayed.



Item	Description
Description	Display parameter description.
Default value	Display default value of parameter.
Range	Parameter setting range (minimum value to maximum value). Parameter in form of bit will not be displayed.
Current set value	Display current value of parameters. For writable parameters, the parameter value being edited in parameter setting area will be displayed. If the EDS file specifies parameter scaling (unit conversion), unit will also be displayed.
Remarks	Display any supplementary parameter information.

Result list area

Result list area displays results of transmission adapter settings (read/write/verify) or reset adapter.



Cursor will move to the target adapter or parameter after double clicking error or NG items displayed in result list area.

If troubleshooting No. is available in result list description, see troubleshooting displayed in Help menu.

File

The following describes various functions in "File(F)" menu.

Read from the scan list

File(F) ▶ Read from the scan list(I)

Reads the target adapter of transmission adapter settings from scan list.

1 **Select "File(F)" ▶ "Read from the scan list(I)" from the menu.**

EtherNet/IP adapters registered in scan list will be read into "Node list" area.

Open backup sensor settings file

File(F) ▶ Open backup sensor settings file(O) Ctrl + O

Opens saved backup sensor settings file.

1 **Select "File(F)" ▶ "Open backup sensor settings file(O)" from the menu.**

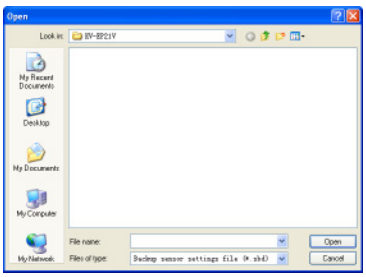
"Open file" dialog box is displayed.

2 **Specify backup sensor settings file to be read.**

Reference

This can also be used for backup sensor settings file in backup sensor settings function.

For backup sensor settings function, see "7-4 Backup Sensor Settings", page 7-7.



3 **Click the "Open" button.**

Content of specified backup sensor settings file will be read into "Transmission adapter settings" dialog box.

Point

If the adapter setting read from backup sensor settings file differs from the unit setting in scan list (different node address), or does not exist, it will be grayed out. While transmission adapter settings for adapters are available in scan list, execute re-assignment. For re-assignment, see "Re-assign", page 5-58.

Save backup sensor settings file

File(F) ▶ Save backup sensor settings file(B) Ctrl + S

Save setting data of transmission adapter settings.

1 Select "File(F)" ▶ "Save backup file(B)" from the menu.

The "Save as" dialog box is displayed.

2 Save after specifying project folder (directory) and file name to be saved.

Reference

Saved setting data can also be used for backup sensor settings file in backup sensor settings function. Backup sensor settings file saved in transmission adapter settings can also be used in backup sensor settings function.
For backup sensor settings function, see "7-4 Backup Sensor Settings", page 7-7.

Point

Parameters other than backup sensor settings object for reading (attribute R) will not be saved in backup sensor settings file.

Verify backup sensor settings file

File(F) ▶ Verify backup sensor settings file(V)

Verifies setting data of transmission adapter settings and backup sensor settings file.

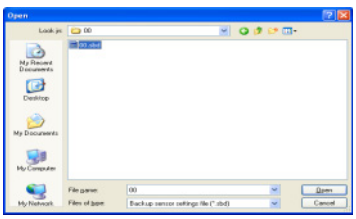
1 Select "File(F)" ▶ "Verify backup sensor settings file(V)" from the menu.

The "Open file" dialog box is displayed.

2 Specify backup sensor settings file to be verified and click the "Open" button.

Reference

This can also be used for backup sensor settings file in backup sensor settings function. For backup sensor settings function, see "7-4 Backup Sensor Settings", page 7-7.



3 Display verification result.

Verification results will be displayed in result column of node list area, result column of parameter setting area and result list area.

Output CSV file

File(F) ▶ Output CSV file(U)

What is read or changed in transmission adapter settings will be output as CSV file by order of node address, slot No., node name, IP address, parameter No., parameter, set value, type and attribute.

Execution of Transmission Adapter Settings (Communication)

Transmission adapter settings will be executed from the "Communication(T)" menu. The following describes all functions in the "Communication(T)" menu.

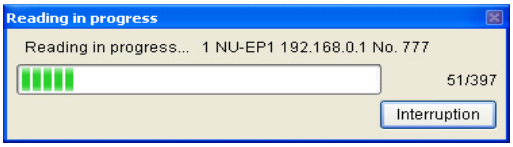
Read adapter

Communication(T) ▶ Read adapter(R)

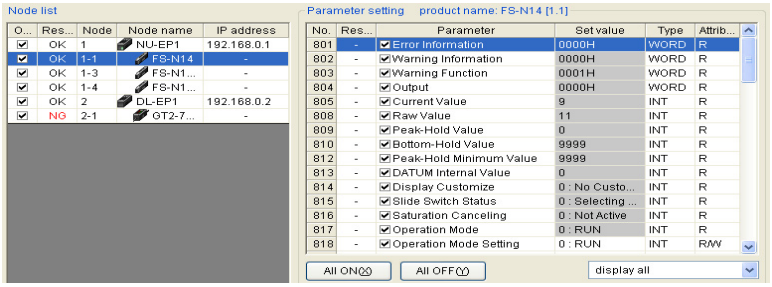
Reads selected parameters from transfer target adapter unit.

1 Select "Communication(T)" ▶ "Read adapter(R)" from the menu.

The "Read in progress" dialog box appears.
Reading will be interrupted when you click "Interrupt" button.



Upon completion of reading, communication result will be displayed in node list area and result column of parameter setting area. Successfully read parameters will be read into set values of parameter setting area.
Causes for NG or any error will be displayed in "result list" area. Cursor will move to target adapter or parameter when you double click an item.



Item	Result	Description
Node list Area	OK	Successful.
	NG	There is a parameter for which reading is failed.
	Error	Communication error.
	SKIP*	Parameter transfer processing is not executed.
	-	Before execution, or not transfer target adapter.
Parameter setting Area	OK	Successful.
	NG	Parameter reading failed.
	Error	Communication error occurs on the adapter when reading parameters.
	SKIP*	Parameter transfer processing is not executed.
	-	Parameters before execution or unreadable.

* Interruption or error occurs during reading transmission adapter settings, processing has been aborted, therefore, SKIP is displayed in result column of the unprocessed nodes (adapters) or parameters.

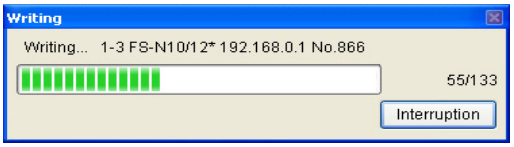
Write adapter

Communication(T) ▶ Write adapter(W)

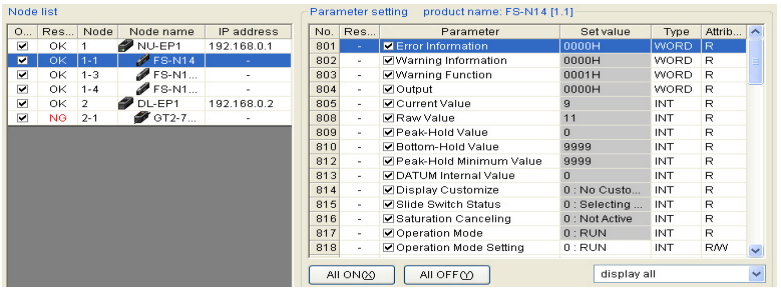
Writes selected parameters into transfer target adapters.

1 Select "Communication(T)" ▶ "Write adapter(W)" from the menu.

The "Write in progress" dialog box appears.
Writing will be interrupted when you click "Interrupt" button.



Upon completion, communication result will be displayed in node list area and result column of parameter setting area.
Causes for NG or any error will be displayed in result list area. Cursor will move to the target adapter or parameter when you double click item.



Item	Result	Description
Node list Area	OK	Successful.
	NG	There is a parameter for which writing failed.
	Error	Communication error.
	SKIP*	Parameter transfer processing is not executed.
	-	Before execution, or not transfer target adapter.
Parameter setting Area	OK	Successful.
	NG	Parameter writing fails.
	Error	Communication error occurs on the adapter when writing parameters.
	SKIP*	Parameter transfer processing is not executed.
	-	Parameters before execution or not writable.

Reset adapter

Communication(T) ▶ Reset adapter(S)

Resets the transfer target EtherNet/IP adapter.

1 Select "Communication(T)" ▶ "Reset adapter(S)" from the menu .

Reset messages will be sent to transmission target adapter.
Execution result will be displayed in result column of node list area. Causes for NG will be displayed in result list area. Cursor will move to the target adapter unit when you double click item.

OK : Reset service executed successfully.
Error : Reset execution failed.
- : Before execution, or non-target adapter of reset service.

Point

For operation after reset, see appropriate adapter manual.

Verify machine parameter

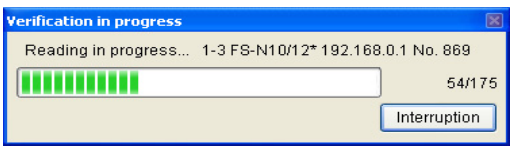
Communication(T) ▶ Verify machine parameter(V)

Verifies settings of parameters of transmission adapter settings and content of parameters of transmission target adapter.

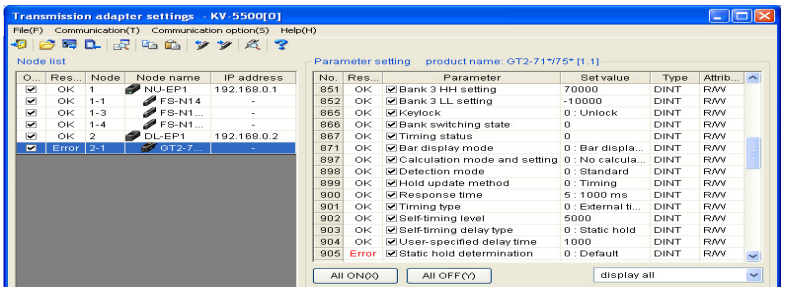
Reference Parameter content for reading will not be verified.

1 Select "Communication(T)" ▶ "Verify machine parameter(V)" from the menu.

The "Verification in progress" dialog box appears. Verification will be exited when you click "Interrupt" button.



Upon completion of verification, communication result will be displayed in node list area and result column of parameter setting area.
Causes for NG or any error will be displayed in result list area. Cursor will move to the target adapter or parameter when you double click item.



Item	Result	Description
Node list Area	OK	Consistent.
	NG	There is a parameter for which verification failed.
	Error	Communication error.
	SKIP*	Verification processing for parameters not executed.
	-	Before execution, or adapter other than verification object.
Parameter setting Area	OK	Settings is consistent.
	NG	Parameter verification failed.
	Error	Communication error occurs on the adapter when verifying parameters.
	SKIP*	Verification processing for parameters not executed.
	-	The parameter used before execution or for reading.

* Interruption or error occurs during verification of transmission adapter settings, processing has been aborted, therefore, SKIP is displayed in the result column of the unprocessed nodes (adapters) or parameters.

Communication Option

Sets options to read/write parameters.
Switch "Check"/"Uncheck" for each selection of menu.

Item	Description
Continue to process in case of error (E)	During transmission of adapter settings, if communication or parameter transmission of some adapters fails, sets whether to continue to execute processing for the remaining adapters or parameter transmission. If checked, continue the remaining processing will be continued.
Compatible with backup sensor settings during operation (I)	Set whether read/write transmission adapter settings runs in the same way as backup sensor settings function. If checked, it runs compatible with backup sensor settings function.
Write in non-volatile storage (F)	Only valid for the adapter to be written in the non-volatile storage when changing settings. If checked, the non-volatile storage will be written when writing transmission adapter settings.
Change mode during writing (M)	To change the setting, valid only for the adapter whose mode needs to be changed. If checked, the mode will be changed when writing transmission adapter settings.

5-13 Calculate Cyclic (I/O) Messages Load Factor

For cyclic (I/O) messages with the adapter or scanner registered in the scan list, communication load used in the cyclic (I/O) messages is calculated and displayed in the "calculate cyclic (I/O) messages load factor" dialog box.

Overview of Cyclic (I/O) Messages Load Factor Calculation

In the "Calculate cyclic (I/O) messages load factor" dialog box, communication load is calculated according to the following cyclic (I/O) messages setting, load factor of the EtherNet/IP Unit and load factor of the adapter and scanner registered in the scan list are also calculated.

- EtherNet/IP Unit tag setting
- Connection setting with adapter
- Connection setting with other scanners

■ Calculation of load factor

Load factor is the quantity of communication data packet sent/received by the EtherNet/IP Device in a second divided by allowable communication bandwidth of cyclic (I/O) messages (quantity of data packet to be sent/received in a second).

$$\text{Load factor} = \frac{\text{Quantity of communication data packet sent/received in a second (pps}^{*}\text{)}}{\text{Allowable communication bandwidth of cyclic (I/O) messages (pps}^{*}\text{)}} \times 100(\%)$$

* pps : Packet Per Second

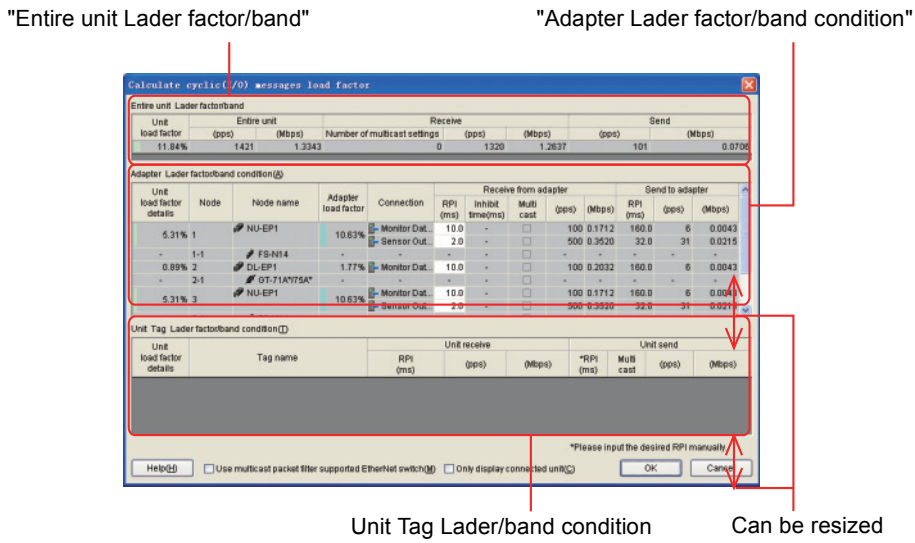
For specific calculation examples of unit load factor, see "Calculation method of load factor", page 4-58. For calculation of allowable communication bandwidth for cyclic (I/O) messages of the adapter, and calculation of load factor, see manuals of respective units.

Display the "Calculate Cyclic (I/O) Messages Load Factor" Dialog Box

Tool(T) ▶ Calculate cyclic(I/O) messages load factor(C)

The "Calculate cyclic (I/O) messages load factor" dialog box will be displayed.

Name and Function of the Parts in "Calculate Cyclic (I/O) Messages Load Factor" Dialog Box



Item	Description
"Entire unit Lader factor/band"	Display total load factor calculation for all units. Display total calculation result of "Adapter - load/band condition" and "Unit tab - load/band condition" respectively.
"Adapter Lader factor/band condition"	Display the load factor calculated according to connection setting of the adapter and scanner setting.
"Unit Tag Lader/band condition"	Display the load factor calculated according to tag setting of the unit.
Use multicast packet filter supported Ethernet Switch	To calculate load factor, set whether to use Ethernet switch that supports multicast packet filter. If not checked, multicast packet is accumulated to the communication traffic of all units.
Only display connected unit	Only unit with connection setting is displayed.
"Help"	Help of "Calculate cyclic (I/O) messages load factor" is displayed.

Point

When the EtherNet/IP Unit operates as the originator, "Calculate cyclic (I/O) messages load factor" will be performed. If any other originator exists on the network, its influence must be considered.

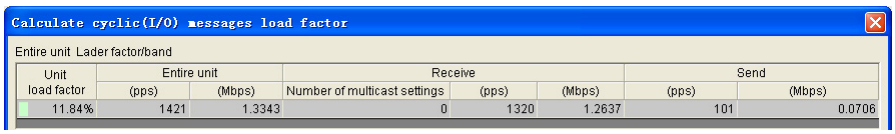
Reference

Preamble, each header size, FCS, and IFG (12byte) should be included when calculating load factor (Mbps).

■ "Entire unit Lader factor/band"

Displays the result of cyclic (I/O) messages load factor calculation for all EtherNet/IP Units.

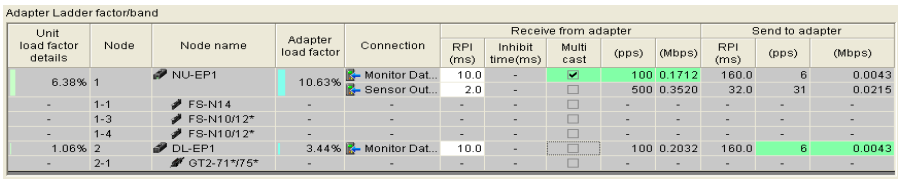
Total load factor of "Adapter - load/band condition" and "Unit tab - load factor/band condition" will be displayed respectively. When load factor exceeds 100%, it will be displayed in red. (according to different calculation results, 100.00% may also be displayed as red.)



Item		Description
Unit load factor		Display load factor of all units.
Entire Unit	(pps)	Communication traffic per second is displayed for all units in pps and Mbps.
	(Mbps)	
Receive	Number of multicast settings	Display total number of connections with multicast. When Ethernet switch supporting multicast packet filter is used, it must be checked so that Ethernet switch will not exceed the number of supported multicast packet filters.
	(pps)	Communication traffic per second in receive direction is displayed for all units in pps and Mbps.
	(Mbps)	
Send	(pps)	Communication traffic per second in send direction is displayed for all units in pps and Mbps.
	(Mbps)	

■ "Adapter Lader factor/band condition"

Load factor calculated according to the communication content of connection settings of the adapter and scanner is displayed. When load factor (adapter load factor) exceeds 100%, it is displayed in red.



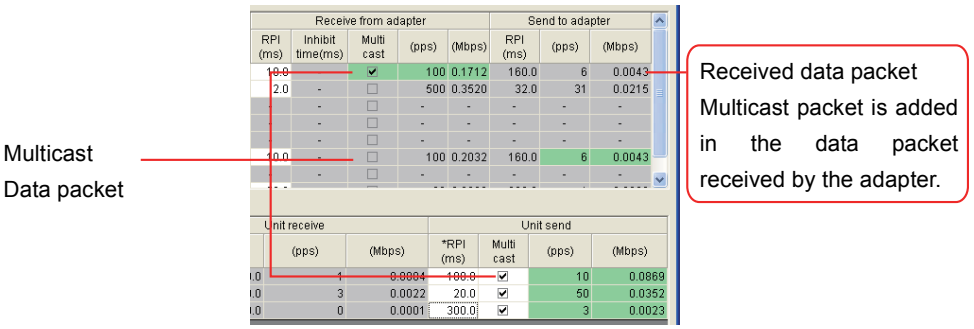
Item		Description
Unit load factor details		Details of unit load factor are displayed for each adapter.
Node		Display node address of the adapter and scanner.
Node name		Display node name of the adapter and scanner.
Adapter load factor		Load factor calculated according to the communication bandwidth defined in the EDS file for the adapter and scanner is displayed.
Connection name		Display connection name of setting.
Receive from adapter	RPI(ms)	RPI (communication interval) in receive direction of the connection setting is displayed. If the value is changed, calculate load factor again. Click "OK" button to update connection setting.
	Inhibit time (ms)*	If Change of State (COS) trigger is set in the connection setting, production inhibit time (RPIx1/4) is displayed.
	Multicast	Check is when connection type of the connection setting is set to multicast.
	(pps)	Communication traffic per second in receive direction is displayed in pps and Mbps.
	(Mbps)	

Item		Description
Send to adapter	RPI(ms)	RPI (communication interval) in send direction of the connection setting is displayed. If the value is changed, calculate load factor again. Click "OK" button to update to connection setting.
	(pps)	Communication traffic per second in send direction is displayed in pps and Mbps.
	(Mbps)	

* If Change of State (COS) trigger is set in connection setting, calculate load factor from adapter receive direction based on production inhibit time (RPIx1/4).

● Load factor in send-to-adapter direction

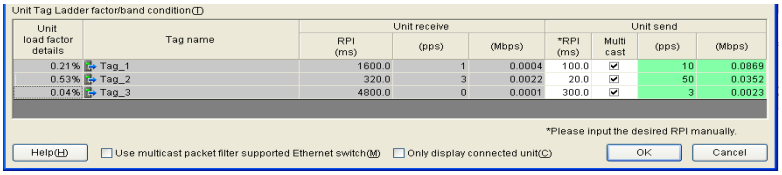
If an Ethernet switch supporting multicast packet filter is not used, multicast packets sent by the adapter and scanner, as well as multicast packets sent by the unit (KV-EP21V) will become communication load of all units. In "Calculate cyclic (I/O) messages load factor" dialog box, communication load of the sent multicast packets is displayed in green background color.



Reference If "Use Ethernet switch supporting multicast packet filter" is checked, then multicast packets of other adapters and EtherNet/IP Units will not be added.

■ "Unit Tag Lader/band condition"

Displays the load factor calculated according to the communication content set in the unit tag setting.



Item		Description
Unit load factor details		Display details of unit load factor for each tag setting.
Tag name		Display tag name.
Unit receive	RPI(ms)	Display "*RPI (ms)" as a value of 16 times. *1
	(pps)	Display the communication traffic calculated according to the RPI (16 times of "*RPI (ms)") *1 in pps and Mbps.
	(Mbps)	
Unit send	"*RPI(ms)"	Input RPI (ms) for sending to other scanners. Initial value is displayed as the "refresh period during standby" set in the tag setting.
	Multicast *2	Check it to calculate load factor when multicast sends communication data of tag setting.
	(pps)	Display the communication traffic calculated based on "*RPI (ms)" in pps and Mbps.
	(Mbps)	

***1 When 16 times value of "*RPI (ms)" exceeds 10s, RPI is calculated as 10s.**

***2 If "Use Ethernet switch supporting multicast" is not checked, multicast packets of the unit are also accumulated to the sent communication load as other adapters and scanners that are not multicast objects.**

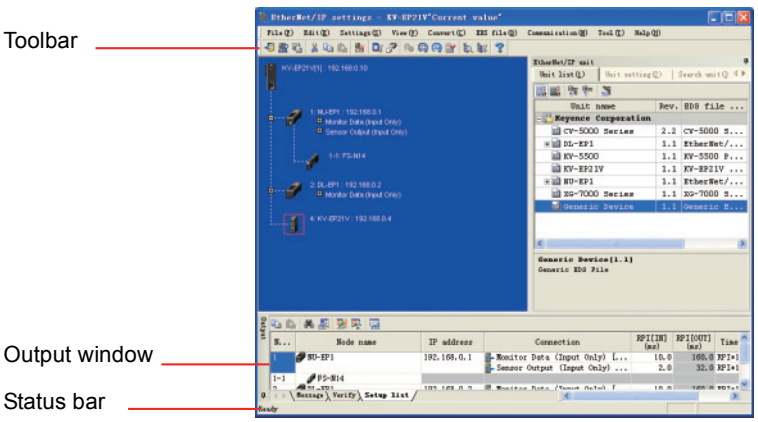
5-14 View/Help

This section describes various functions in "View(V)" menu and "Help(H)" menu.

Toolbar/Status Bar/Output Window

View(V) ▶ Toolbar(T)
Status bar(S)
Output window(O)

Select "View(V)" ▶ "Toolbar(T)", "Status Bar(S)", "Output window(O)" from the menu, so as to display/hide toolbar/status bar/output window.
Display/hide will be toggled by each clicking.
Marked with a tick: display
Not marked with a tick: hide



Switching of Edit Area

View (V) ▶ **Scan list area(U)** Alt + U
▶ **Unit list(1)** Alt + 1
▶ **Unit setting(2)** Alt + 2
▶ **Search unit(3)** Alt + 3
▶ **Message(4)** Alt + 4
▶ **Verify(5)** Alt + 5
▶ **Setup List(6)** Alt + 6

Switch the edit target area.

" Overview of Scan List Area", page 5-9
" "Unit List" Tab", page 5-16
" "Unit Setting" Tab", page 5-22
" "Search Unit" Tab", page 5-24
" "Message" Tab", page 5-36
" "Verify" Tab", page 5-37
" "Setup List" Tab", page 5-38

How to Use EtherNet/IP Setting

Help(H) ▶ **Usage of EtherNet/IP Setting(H)** F1

Select "Help(H)" ▶ "Usage of EtherNet/IP Setting (H)" from the menu, so as to display the help window of EtherNet/IP Setting.

MEMO

6

OPERATION OF KV DATALINK+ for EtherNet/IP

By using the KV DATALINK+ for EtherNet/IP attached to KV STUDIO, following the instructions and entering the necessary information, setting data sending and receiving to and from the EtherNet/IP scanner can be carried out easily.
This chapter describes how to operate KV DATALINK+ for EtherNet/IP.

6-1 Overview of KV DATALINK+ for EtherNet/IP 6-2
6-2 Startup and Exit KV DATALINK+ for EtherNet/IP . . . 6-4
6-3 Name and Function of Parts of Screen 6-5
6-4 Data Link Setup Procedures 6-7
6-5 How to Operate Setup Wizard 6-11
6-6 View Setting 6-19
6-7 Update to the KV STUDIO Project 6-34
6-8 Other Functions 6-37

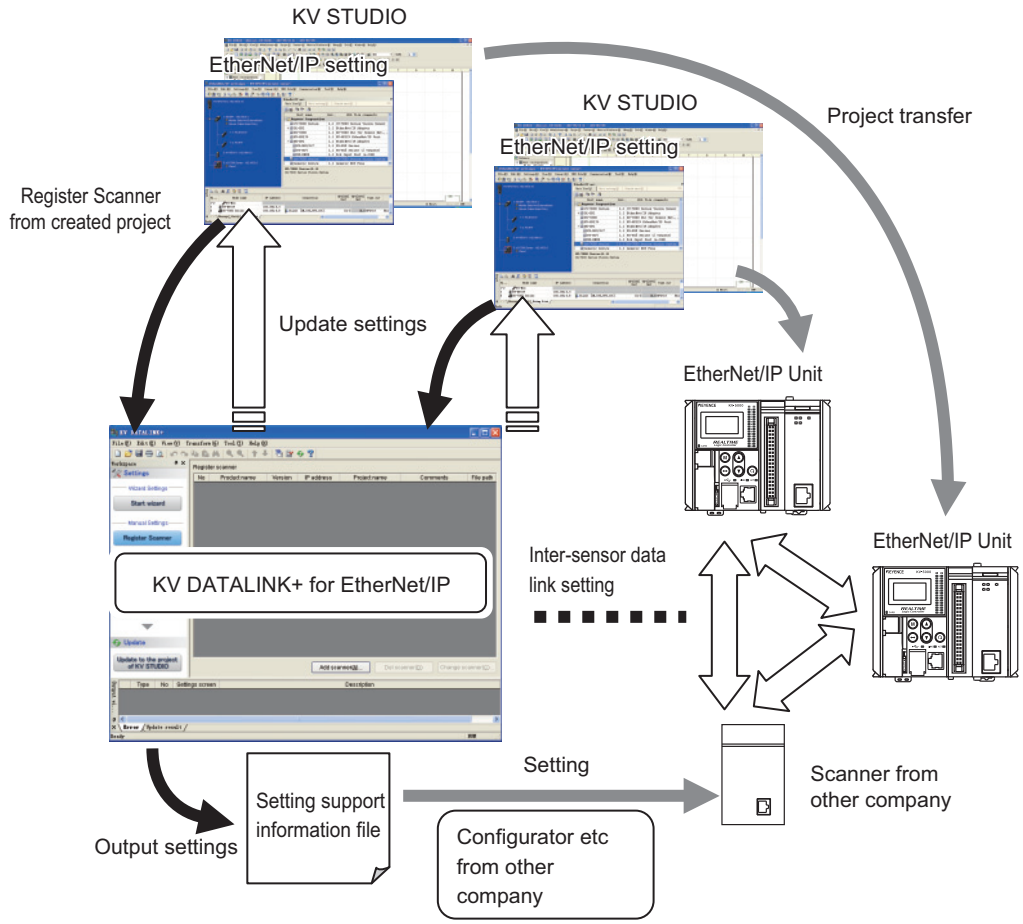
6-1 Overview of KV DATALINK+ for EtherNet/IP

This section describes "KV DATALINK+ for EtherNet/IP".

Function of KV DATALINK+ for EtherNet/IP

"KV DATALINK+ for EtherNet/IP" is a software attached with "KV STUDIO", used to set data link between KEYENCE scanners (KV-EP21V, KV-5500 or KV-NC1EP) and scanners from other companies. Follow the steps to set data link between scanners (tag setting and connection setting) easily.

Settings of KEYENCE scanner set in "KV DATALINK+ for EtherNet/IP" can be updated to each project of "KV STUDIO".



* Scanner that can be registered to "KV DATALINK+ for EtherNet/IP" is as follows.

KEYENCE scanners

KV-EP21V, KV-5500 or KV-NC1EP set as unit in "KV STUDIO" project

Scanners from other companies

- Scanners registered in the scan list of "EtherNet/IP setting" of "KV STUDIO"
- Scanners which EDS file is registered in "EtherNet/IP setting" of "KV STUDIO"

Point

Before setting data link with "KV DATALINK+ for EtherNet/IP", project should be created via "KV STUDIO". Scanner is selected from the created project, and then data link is set up with "KV DATALINK+ for EtherNet/IP".

Setting

Before setting up via "KV DATALINK+ for EtherNet/IP", a "KV STUDIO" project should be created, and EtherNet/IP Unit should be set as unit.

Set unit.
Set unit (KV-EP21V, KV-5500 or KV-NC1EP) via Unit Editor of "KV STUDIO".
"Chapter 3 UNIT SETTING", page 3-1

After exiting unit setting, save "KV STUDIO" project.
"KV STUDIO User's Manual"

Set via "KV DATALINK+ for EtherNet/IP".

If a scanner from other companies is used, the scanner (EDS file) should be registered in "EtherNet/IP setting" of "KV STUDIO". If a scanner from other companies is used, before using "KV DATALINK+ for EtherNet/IP", the following operation must be performed.

Start up "EtherNet/IP setting".
"Startup and Exit of EtherNet/IP Setting", page 5-7

Scanner (EDS file) from other companies is registered in "EtherNet/IP setting".
"Register to "Unit List" tab of EtherNet/IP Device (EDS file)", page 5-18

6-2 Startup and Exit KV DATALINK+ for EtherNet/IP

This section describes how to start up and exit "KV DATALINK+ for EtherNet/IP".

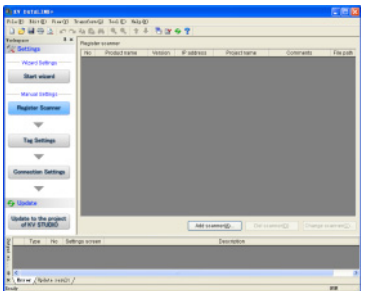
Startup

■ Startup "KV DATALINK+ for EtherNet/IP" from KV STUDIO

"KV DATALINK+ for EtherNet/IP" can be started up from "KV STUDIO".

1 **Select "Tool(T)" ▶ "Startup KV DATALINK+ for EtherNet/IP (D)" from the menu of EtherNet/IP setting.**

"KV DATALINK+ for EtherNet/IP" will start up.



Other procedure
- Select "KV DATALINK+ for EtherNet/IP" from the shortcut column "Relevant software" in the workspace.
- Select EtherNet/IP Unit in the KV STUDIO workspace, then select "KV DATALINK+ for EtherNet/IP" from the right-click menu.
- Click "  " on the "Unit setting (2)" tag of the EtherNet/IP Unit in Unit Editor.

■ Separately startup of "KV DATALINK+ for EtherNet/IP ".

The following describes how to start up "KV DATALINK+ for EtherNet/IP" separately.

1 **Select "Program" ▶ "KEYENCE Applications" ▶ "KVS Ver.* (* 6) tool" ▶ "KV DATALINK+ for EtherNet/IP" from the start menu in turn.**

"KV DATALINK+ for EtherNet/IP" will start up.

Exit

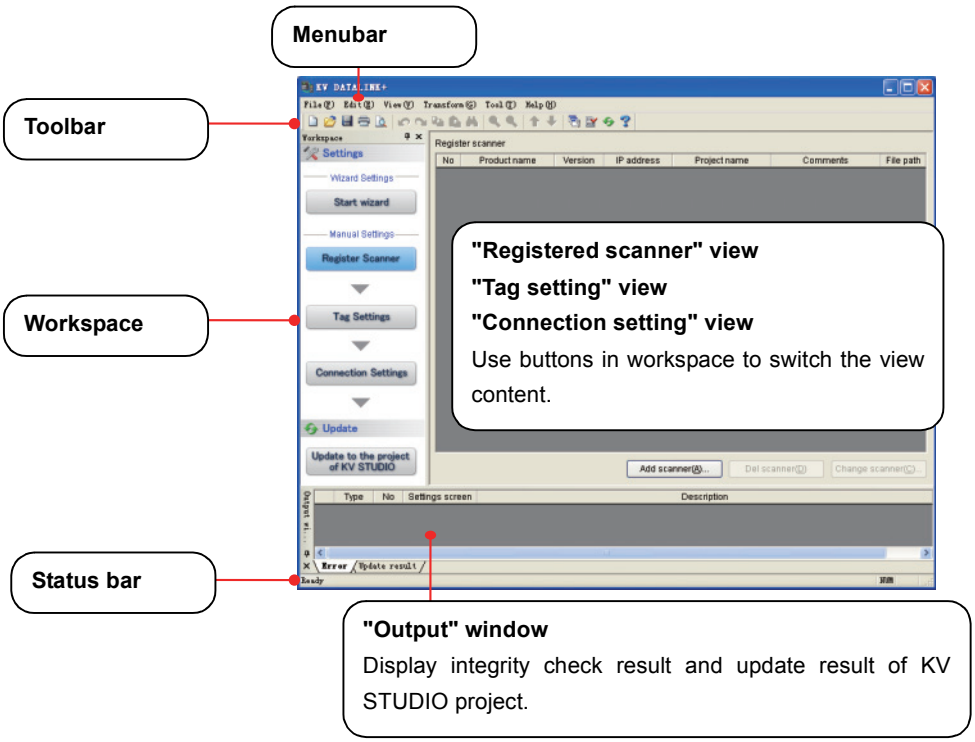
"File(F)" ▶ "Exit(X)" Alt **+** F4

1 **Select "File(F)" ▶ "Exit(X)" from the menu of "KV DATALINK+ for EtherNet/IP" in turn.**

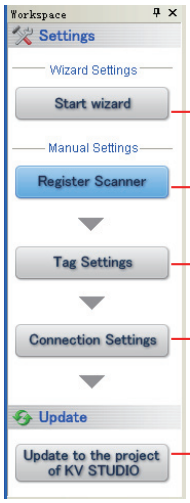
Other procedure Click " " on the right of the titlebar of "KV DATALINK+ for EtherNet/IP".

6-3 Name and Function of Parts of Screen

This section describes name and function of parts of "KV DATALINK+ for EtherNet/IP" are described.



● Workspace



"Start wizard" button
Start setup wizard. page 6-11

"Register scanner" button

"Tag settings" view

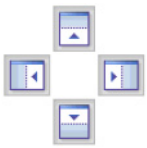
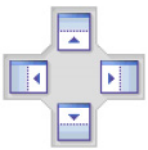
"Connection settings" button

Switch the setting view.

"Update to KV STUDIO project" button
Setting data will be updated to "KV STUDIO" project directly.

● Docking navigator

The docking navigator for specifying the configuration destination will be displayed when dragging workspace or output window. When dropping above the docking navigator, the window is connected to the specified position. At the same time, docking position is displayed as grid on the menu.

Docking navigator type	Description
	Displayed on top, bottom, left and right of the edit menu. When dragging on these marks, connect to top, bottom, left and right of the edit menu.
	It is displayed when the cursor is on the setup screen. To drop on top, bottom, left and right marks, connect to top, bottom, left and right of the setup screen.

● Auto-hide function

This function allows to display workspace and output window only required. In the workspace and output window connected to top, bottom, left and right of the edit menu, click the nail head icon on upper right corner.

Icon	Description
	Workspace and output window keep display status.
	Workspace and output window are displayed as tabs on top, bottom, left and right of the edit menu. It is displayed by moving the cursor to tab, or double-clicking tab.

6-4 Data Link Setup Procedures

This section describes how to use the setup wizard of "KV DATALINK+ for EtherNet/IP" to set up data link. A "KV STUDIO" project with EtherNet/IP Unit set as the unit should be created.

Data Link Setup Procedures

1 **Use the "KV STUDIO" Unit Editor to create a project that uses the EtherNet/IP Unit as a unit.**

See "Setting", page 6-3.

2 **Start up "KV DATALINK+ for EtherNet/IP".**

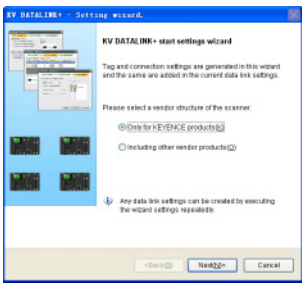
See "6-2 Startup and Exit KV DATALINK+ for EtherNet/IP", page 6-4.

3 **Click** Start wizard **button in workspace.**

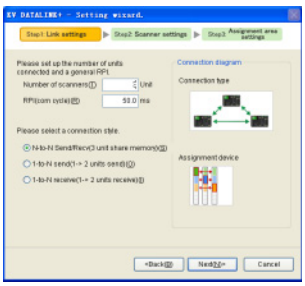
Display "Setup wizard" dialog box.

Set up data link according to the setup wizard.

4 **Select the desired scanner from "only for KEYENCE product" or "including product from other companies", click "Next" button.**

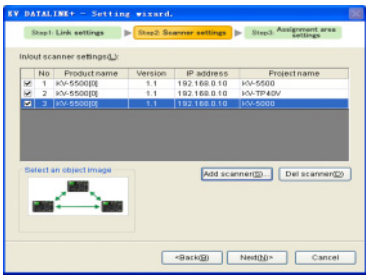


5 **Input number of scanners and RPI (communication period), select connection type, and then click "Next" button.**



6 Use "Add scanner" button, select a scanner.

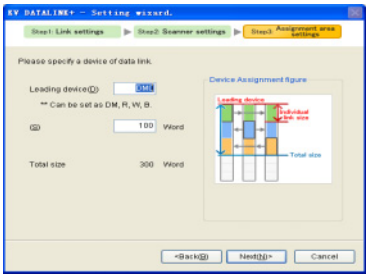
Select KEYENCE scanner from the scanners used in the "KV STUDIO" project.
Select a scanner from other companies from the scanner registered in "EtherNet/IP setting".

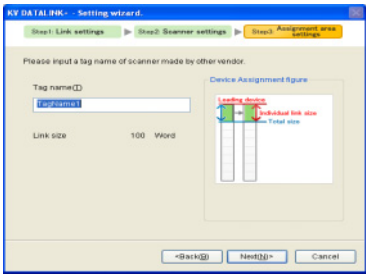


Point

If a scanner from other companies is used, EDS file must be registered in "KV DATALINK+ for EtherNet/IP". Select a scanner from other companies from the EtherNet/IP Device where EDS file is registered.

7 Input the assignment area used in the data link.

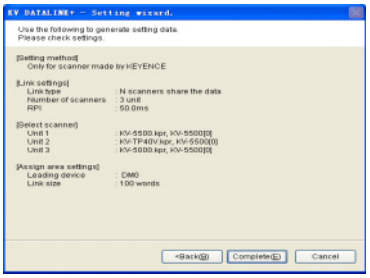




For KEYENCE scanner, set leading device and size used in the data link.
For scanner from other companies, set tag name used in the data link.

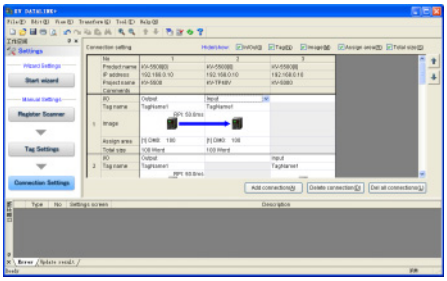
8 Display inputs of data link setting.

If there is no problem, click "Finish" button.



9 After setup wizard is finished, the setting of data link will be added to "KV DATALINK+ for EtherNet/IP".

The set scanner and data link will be added to "Registered scanner" view, "Tag setting" view, and "Connection setting" view.



10 To add other data link settings, repeat steps 1 to 9.

Point

The data link setting created with setup wizard will be added upon completion.

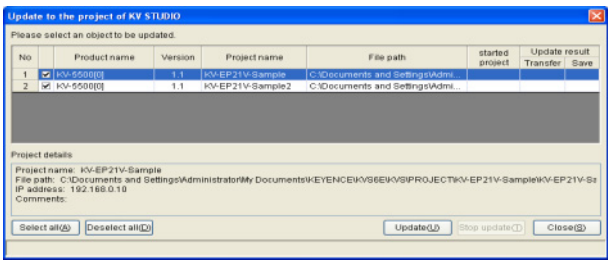
Thus, the setting of data link is completed.

For how to operate the setup wizard, see "6-5 How to Operate Setup Wizard", page 6-11.

Setting will be updated to each project of "KV STUDIO" later.

11 Click " Update to the project of KV STUDIO " button in workspace.

Display "update to KV STUDIO project" dialog box.



12 Select the project that needs to update setting, and click " update" button.

Settings in "KV DATALINK+ for EtherNet/IP" will be updated directly to each project.

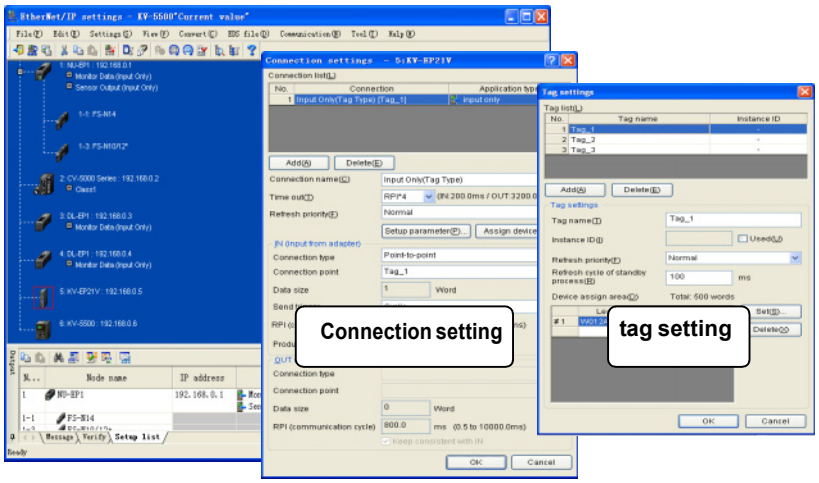
Point

If a scanner from other companies is used, select "File" ▶ "Export setup auxiliary information" from the menu, use the output support setting information file, and use the configurator from other company for setting.

13 Confirm the update result of "update to KV STUDIO project" dialog box.

If there are no problems, connection setting (the KV-EP21V receives data from other scanners), tag setting (the EtherNet/IP Unit sends data to other scanners) of the EtherNet/IP setting data for each project will update correctly.

"EtherNet/IP setting"



Point

- **If the updated project has been started, the setting will be updated immediately, but will not be saved in the unit setting.Save after execute setting check.**
- **When updating from "KV DATALINK+ for EtherNet/IP" to the project, connection setting information is always set to multicast. To change the connection type, each project must be changed.**

6-5 How to Operate Setup Wizard

This section describes settings of data send/receive using Setup Wizard.
If setup wizard is used, data link between the scanners can be set up easily in the steps according to the dialog box. Setup wizard can be used not only to create data link setting, but also to add data link setting.

How to Operate Setup Wizard

1 Click " Start wizard " button in workspace.

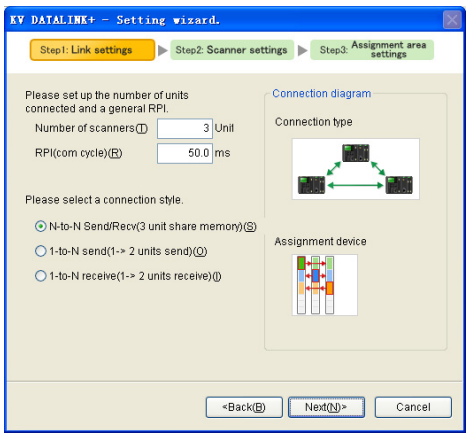
Display "KV DATALINK+ setup wizard" dialog box.
Select the desired scanner from "only limited to KEYENCE product" or "including product from other companies", click "next" button.



■ Select "only limited to KEYENCE product"

2 Input the desired number of scanners, RPI (communication period), select connection type, and then click "next" button.

For the connection type, see "Data can be Sent/ Received via Setup Wizard Setting", page 6-15.



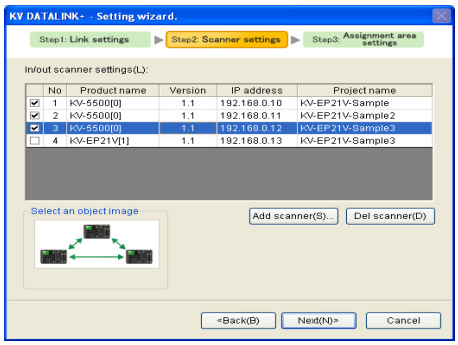
Point

For Wizard Setup, data send/receive RPI (communication period) between scanners is set to the same value. If change is required, after Wizard Setup, make change in the "Connection setting" view.
"Change RPI", page 6-31

3 Click "Add scanner" button, select the desired scanner from "KV STUDIO" project according to the set quantity.

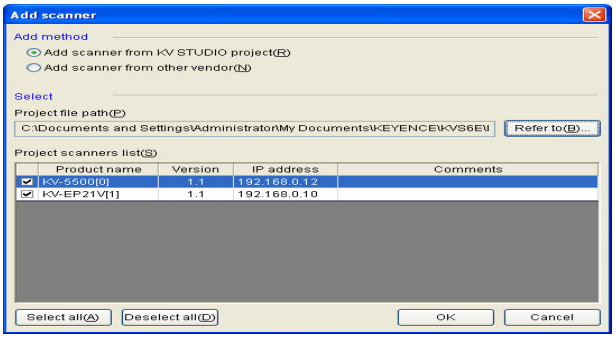
Point

The scanner added to scanner setting list will be saved in KV DATALINK+ setting file, so it is unnecessary to select from "Add scanner" dialog box every time.



● "Add scanner" dialog box

In "Add scanner" dialog box, select the scanner (EtherNet/IP Unit) set to each project.



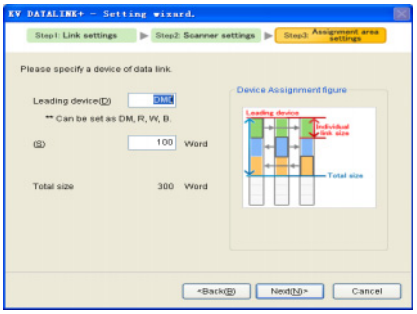
Item	Description
Project file path	Display the file path of the selected "KV STUDIO" project.
"Browse"	Select "KV STUDIO" project. Click "Browse" button, display "Open file" dialog box.
Scanner list of project	Display the scanner included in the selected project. The selected scanner will be added to input/output scanner setting list.
"select all"*	Select all displayed scanners.
"Unselect all"*	Unselect all scanners.
"OK"	The selected scanner will be added to input/output scanner setting list.

* It will not be displayed if only one scanner can be selected.

4 Input data link size between scanners and leading device in the data link.

Point

Leading device No. for data send/receive of scanners assigned in the setup wizard is universal.



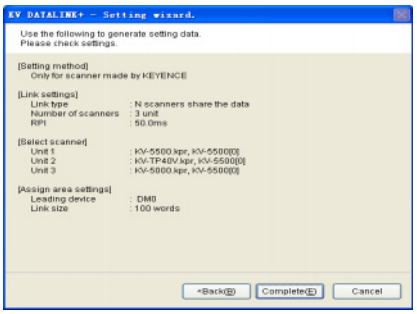
5 Display input content.

If there is no problem, click "OK" button.

Scanner and data link setting in the setup wizard will be added to "Registered Scanner" view, "Tag setting" view, and "Connection setting" view.

Update setting data of "KV STUDIO" project.

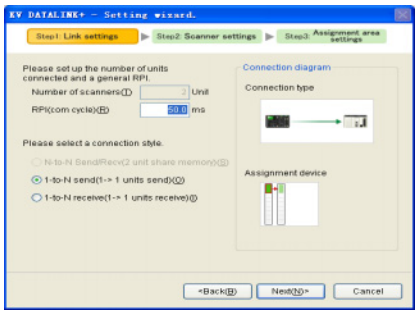
"6-7 Update to the KV STUDIO Project", page 6-34



■ Select "including product from other companies",

2 **input RPI (communication period), select connection type, then click "next" button.**

For the connection type,
see "Data can be Sent/Received via Setup Wizard Setting", page 6-15.

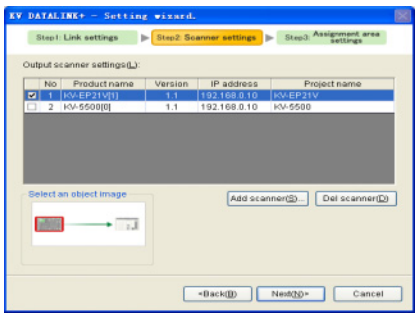


Point

If a scanner from other companies is used, select 1-to-1 send or 1-to-1 receive with KEYENCE scanner.
If send/receive is required, or two or more scanners from other companies are used, always perform wizard setting again to add data link setting after setting.

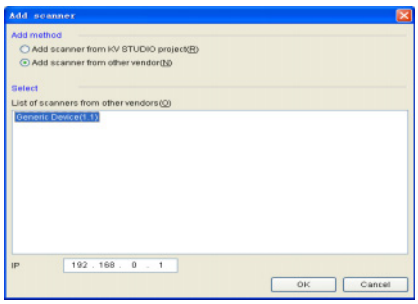
3 **Click "Add scanner" button, select the desired KEYENCE scanner from "KV STUDIO" project, and click "Next" button.**

The first scanner should be KEYENCE scanner. For the selection method,
see "Concerning "add scanner from KVS project"", page 6-20.

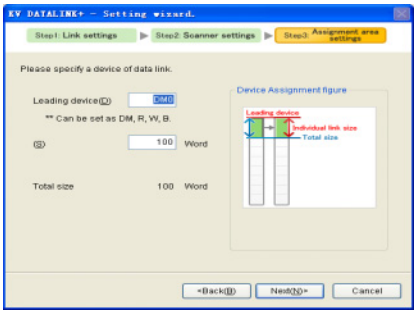


4 **Click "Add scanner" button, select scanner from other companies, and click "Next" button.**

Select a scanner from other companies for the second scanner. For the selection method,
see "In case of "add scanners from other vendors",", page 6-20.



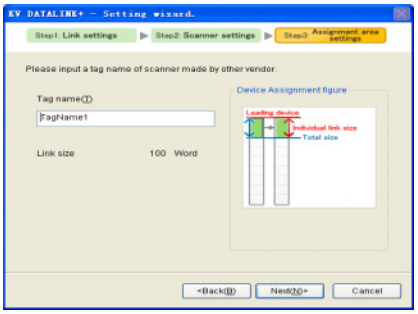
5 **Input leading device and data size in the set data link area for KEYENCE scanner, and click "next" button.**



6 **Input tag name of scanners from other companies in the data link.**

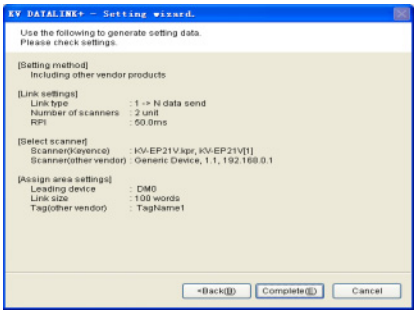
Point

KEYENCE scanner uses automatically assigned tag name in the data link.



7 **Display input content.**

If there is no problem, click "OK" button.
Scanner and data link setting in the setup wizard will be added to "Registered Scanner" view, "Tag setting" view, and "Connection setting" view.



Setting data of KEYENCE scanner must be updated to "KV STUDIO" project.
"Update to the KV STUDIO project.", page 6-47

To set a scanner from other companies, select menu "File" ▶ "Export setup auxiliary information, use the output support setting information file for setting via configurator from other companies.
"Export support setting information", page 6-38

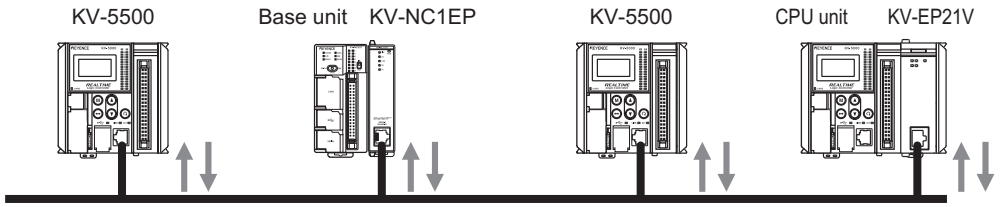
Data can be Sent/Received via Setup Wizard Setting

Data send/receive via Setup Wizard Setting is described.

■ In case only KEYENCE scanner is used

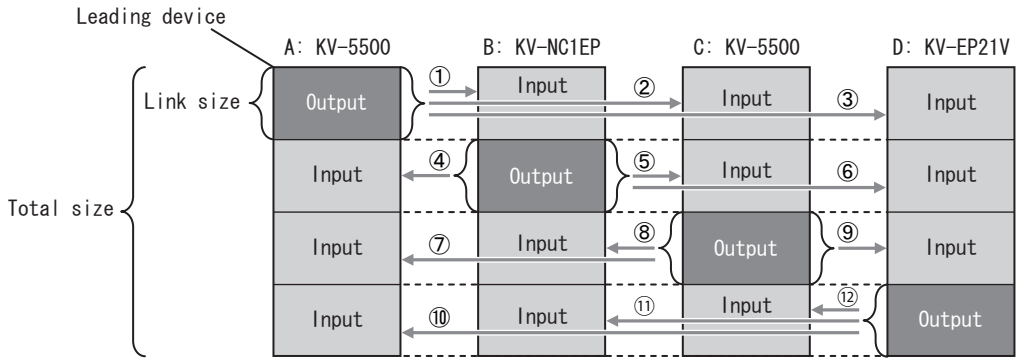
● N-to-N send/receive

This setting is used to share data among the connected CPU units. Up to 256 units can be set. Set data link (connection) between CPU units by setting RPI (communication period) and link size.



Example) When data link settings have been set to send/receive data in the form of N-to-N between two KV-5500, one KV-NC1EP and one KV-EP21V

Set up the connection as follows. Leading device of each CPU unit is common.

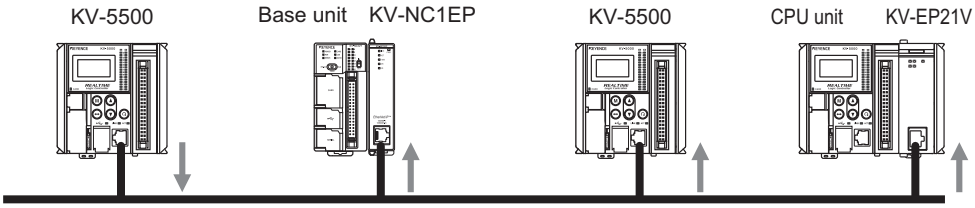


Created connections (12)

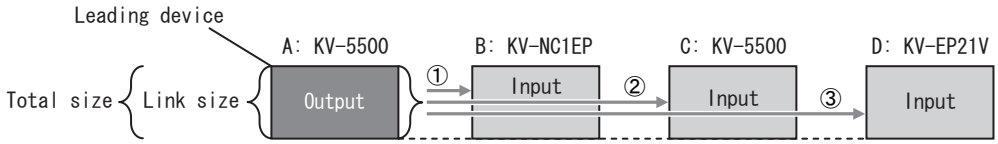
(1) Connection of scanner A-> scanner B
(2) Connection of scanner A-> scanner C
(3) Connection of scanner A-> scanner D
(4) Connection of scanner B-> scanner A
(5) Connection of scanner B-> scanner C
(6) Connection of scanner B-> scanner D
(7) Connection of scanner C-> scanner A
(8) Connection of scanner C-> scanner B
(9) Connection of scanner C-> scanner D
(10) Connection of scanner D-> scanner A
(11) Connection of scanner D-> scanner B
(12) Connection of scanner D-> scanner C

● 1-to-N send

This setting is used to send data of one CPU unit to all connected CPU units.
Up to 256 units can be set. Set the connection for sending data from one CPU unit to each KV-EP21V, KV-5500 and KV-NC1EP according to the set RPI (communication period) and link size.



Example) between one KV-5500 and one KV-NC1EP, and one KV-5500 and one KV-EP21V, when 1-to-N send is selected, and data link setting has been carried out, set the following connection.

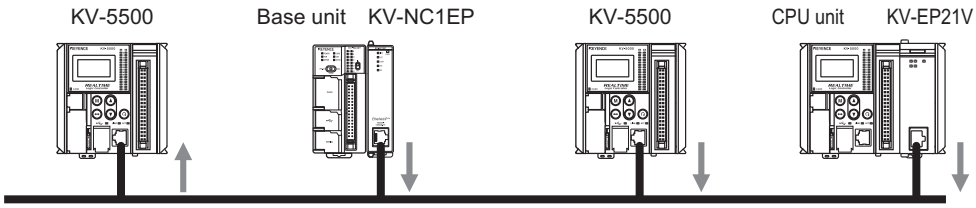


Created connections (3)

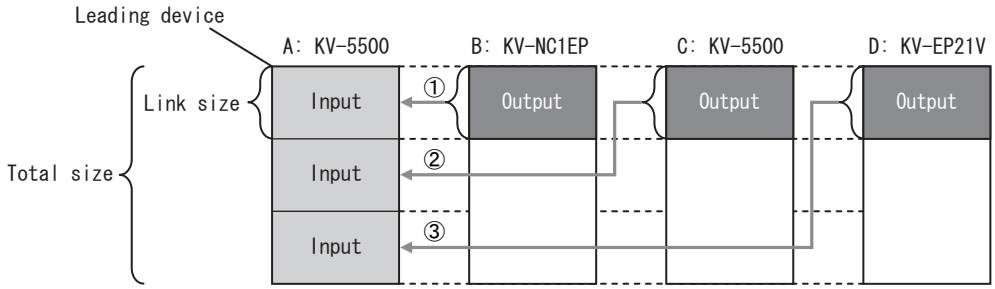
(1) Connection of scanner A-> scanner B
(2) Connection of scanner A-> scanner C
(3) Connection of scanner A-> scanner D

● 1-to-N receive

This setting is used for one CPU unit to receive data from all connected CPU units.
Up to 256 units can be set. Set up the connection for one CPU unit to receive the data of each KV-EP21V, KV-5500 and KV-NC1EP according to the set RPI (communication period) and link size.



Example) between one KV-5500, one KV-NC1EP, one KV-5500, and one KV-EP21V, when 1-to-N receive is selected, and data link setting has been carried out, set the following connection.



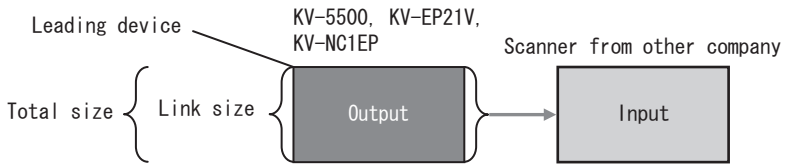
Created connections (3)

(1) Connection of scanner A-> scanner B
(2) Connection of scanner A-> scanner C
(3) Connection of scanner A-> scanner D

■ Use KEYENCE scanner and scanners produced by other companies

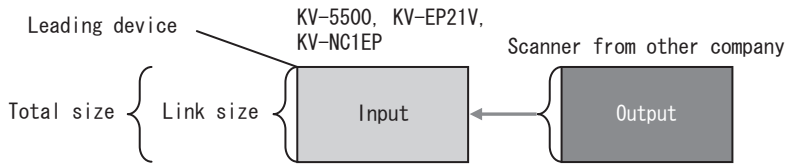
● 1-to-1 send

This setting is used to send data to scanners produced by other companies from KEYENCE scanner.
Set data send connection according to the set RPI (communication period) and link size.



● 1-to-1 receive

This setting is used for KEYENCE scanner to receive data from scanners produced by other companies.
Set data receive connection according to the set RPI (communication period) and link size.



Point

If send/receive is required, or two or more scanners from other companies are used, wizard setting must be performed again to add data link setting.

6-6 View Setting

Provide instructions on "registered scanner" view, "tag setting" view and "connection setting" view of "KV DATALINK+ for EtherNet/IP".

Register Scanner View

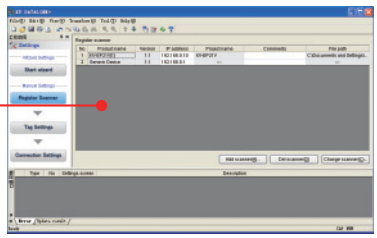
"View(V)" ▶ "Register scanner(1)" Alt **+** 1

In the "register scanner" view, display the registered scanner in "KV DATALINK+ for EtherNet/IP". Do not use setup wizard, and apply the "register scanner" view to register, remove and adjust the scanner.

1 Click the "register scanner" button in the workspace.

Display the "register scanner" view.

Register scanner view



Register scanner

No	Product name	Version	IP address	Project name	Comments	File path
1	KV-5500[0]	1.1	192.168.0.10	KV-EP21V-Sample		C:\Documents and Settings\Admini...
2	KV-5500[0]	1.1	192.168.0.11	KV-EP21V-Sample2		C:\Documents and Settings\Admini...
3	KV-5500[0]	1.1	192.168.0.12	KV-EP21V-Sample3		C:\Documents and Settings\Admini...

Project of registered scanner

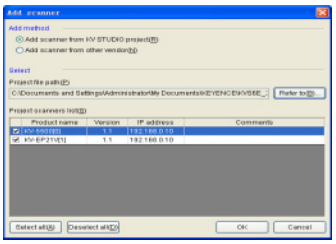
Item	Description
No	Display the sequence number of scanner's registration. Rearrange the assignment in accordance with the registration order when the scanner is removed.
Product name	Display the name of product (name of unit) In case of scanner from KEYENCE, add "unit No." at the end of product name and then display.
Version	Revision of scanner is displayed in the format of "major revision"/"minor revision". The number of revision means the version of functions added to EtherNet/IP Device.
IP address	Display IP address. IP address may also be changed.
Project name	In case of scanner from KEYENCE, display the project name of "KV STUDIO".
Comments	Enter comments. Setting range: a maximum of 32 half-width characters
File path	In case of scanner from KEYENCE, display the file path of "KV STUDIO" project

■ Add scanner

Click the "add scanner" button in the "registered scanner" view, and the "add scanner" dialog box will prompt.

● Concerning "add scanner from KVS project"

Select the scanner that is registered under the scan list of "EtherNet/IP setting" from the "KV STUDIO" project. You can also select the KEYENCE scanner that is set as a unit and register it on the other side as scanners from other companies.
When Generic Unit is used as a scanner, its setting is the same with scanners from other companies.



Point

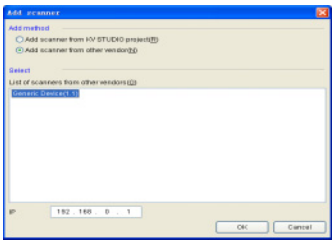
Do not select KEYENCE scanners registered on the other side of scan list. Select from projects that are set as a unit

Item	Description
Project file path	Display the file path of "KV STUDIO" project.
"Refer to"	Click "Browse" button, display "Open file" dialog box. Select "KV STUDIO" project with scanner included.
Project scanners list	display the project name, revision, IP address and comments of scanners included in the selected project. Select the scanner to be added
"select all"*	Select all displayed scanners.
"Unselect all"*	Unselect all scanners.
"OK"	Add the selected scanner to the "registered scanner" view

* It will not be displayed if only one scanner can be selected.

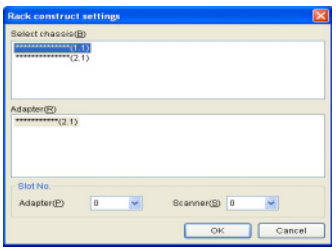
● In case of "add scanners from other vendors",

select registered scanners from other vendors from "EtherNet/IP setting" of KV STUDIO. Enter the IP address to select.
For the methods of registering EtherNet/IP Device (EDS file) to EtherNet/IP setting,
see "Register to "Unit List" tab of EtherNet/IP Device (EDS file)", page 5-18.
When Generic Unit is used as a scanner, its setting is the same with scanners from other companies.



Concerning selected scanner with rack configuration unit

Select rack unit and communication adapter; enter the slot No. of communication adapter and scanner.



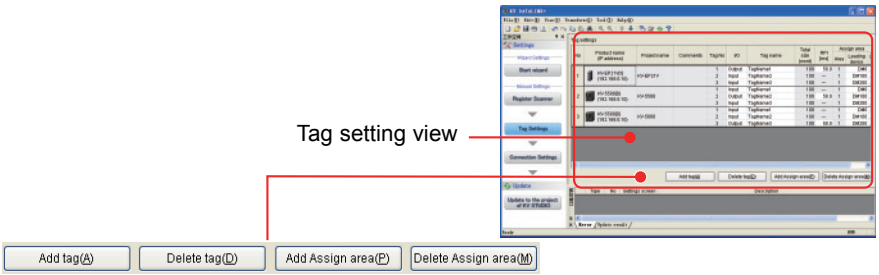
tag setting view

"View(V)" ▶ "Setup tag(2)" Alt + 2

Display the tag settings of each scanner in the "tag setting" view Do not use setup wizard. Apply the "tag setting" view to add, adjust and delete tag setting as well as the device assignment area of all units.

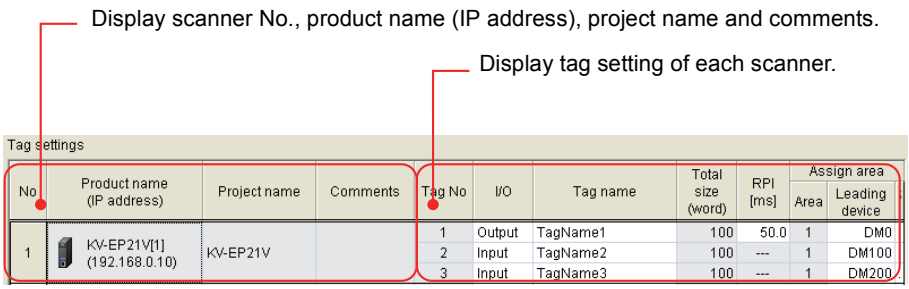
1 Click the "tag setting" button in the workspace.

"tag setting" view



Click respective buttons to add/delete tag setting and assignment area.

● "tag setting" view



Item	Description
tag No.	Display the number of creation sequence of tag setting Rearrange the assignment in accordance with the creation order when the tag setting is deleted.
I/O	Input: tag setting for receiving data from other scanners. Output: tag setting for sending data from other scanners.
tag name	Display tag name. The tag name can also be changed. Setting range: a maximum of 48 half-width characters "," is not allowed.
Total size (word)	• In case of KEYENCE scanner, display the total size (unit: word) of device in the assignment area (8 at most) of tag setting Set the data in each assignment area. • In case of scanners from other companies, display the data size (unit: word) in tag setting (one assignment area). Data size can also be changed.
RPI[ms]	The output of tag setting displays RPI (communication period). RPI (communication period) can also be changed.

Item		Description
Assignment Area *	Area	In case of KEYENCE scanner, display in tag setting the sequence number of creation order of device area. Rearrange the assignment in accordance with the creation order when the device area is deleted.
	Leading device	In case of KEYENCE scanner, enter the leading device of assignment area. Devices to be entered include DM, W, R, B. Use the leading No. of channel when R and B are specified. Use even device when DM and W are specified.
	Size (word)	In case of KEYENCE scanner, enter the data value of each assignment area.

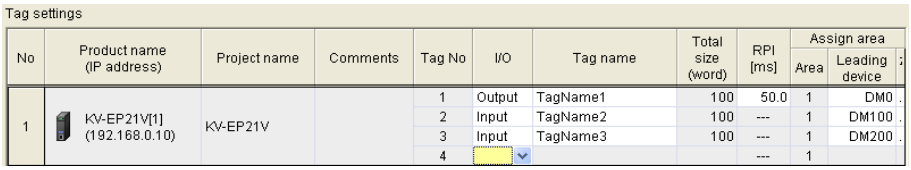
* If the scanner is from other companies, only one area can be set in tag setting.

■ add tag setting

Provide instructions on how to add tag settings by "tag setting" view.

1 Select scanners that need to add tag (setting) and click the "add tag" button.

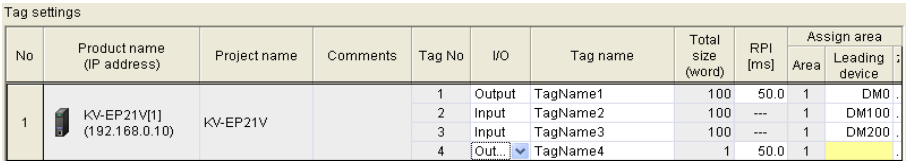
Tag No. will be added.



The background of setting items of input and output is yellow.

2 Select the cell of input and output, and select input/output.

Set up initial value of tag name and RPI The tag name and RPI can also be changed.



In case of KEYENCE scanner, the background color of leading device in the assignment area is yellow.

Reference The "input" and "output" buttons can be used in [I] "input" setting. [O] "output" setting.

● **KEYENCE scanner**

3 **Enter leading device and its size in the assignment area.**

Tag settings

No	Product name (IP address)	Project name	Comments	Tag No	I/O	Tag name	Total size (word)	RPI [ms]	Assign area	
									Area	Leading device
1	KV-EP21V[1] (192.168.0.10)	KV-EP21V		1	Output	TagName1	100	50.0	1	DM0
				2	Input	TagName2	100	---	1	DM100
				3	Input	TagName3	100	---	1	DM200
				4	Output	TagName4	1	50.0	1	DM1000

Here, devices are assigned in the assignment area 1. As for areas coming after assignment area 2, click the "add assignment area" button to set the assignment area.

● **Scanner from other companies**

3 **Change the total size.**

When adding the tag, set the initial value of data defined in the scanner's EDS file.

■ delete tag setting

Provide instructions on how to delete tag settings by "tag setting" view.

1 **Select the tag (setting) to be deleted and click the "delete tag" button.**

If tag setting to be deleted is being used by a certain link, a dialog box will prompt. If there is no problem, click the "yes" button.



Point

Select the cell of product name (IP address), project name and comments, click the "delete tag" button, and then all the tag settings in the scanner will be deleted.

■ Add assignment area (only for KEYENCE scanner)

Provide instructions on how to add assignment area of tag settings by "tag setting" view.
If KEYENCE scanner is used, at most 8 assignment areas can be set in one tag setting.

1 Select the tag (setting) that needs ¨adding assignment area¨ and click "add assignment area" button.

After adding assignment area£¨the background color of leading device is yellow.

Tag settings

No	Product name (IP address)	Project name	Comments	Tag No	I/O	Tag name	Total size (word)	RPI [ms]	Assign area		
									Area	Leading device	Size (word)
1	KV-EP21V[1] (192.168.0.10)	KV-EP21V		1	Output	TagName1	101	50.0	1	DM0	100
									2		1

2 Enter leading device and its size in the assignment area.

Tag settings

No	Product name (IP address)	Project name	Comments	Tag No	I/O	Tag name	Total size (word)	RPI [ms]	Assign area		
									Area	Leading device	Size (word)
1	KV-EP21V[1] (192.168.0.10)	KV-EP21V		1	Output	TagName1	101	50.0	1	DM0	100
									2	DM500	1

■ Delete assignment area (only for KEYENCE scanner)

Provide instructions on how to delete assignment area of tag settings by "tag setting" view.

1 Select the assignment area to be deleted, click "delete assignment area" button.

Assignment area will be deleted.

Point

- **After deleting assignment area, rearrange the number of assignment area.**
  example) If assignment area No. 3 (or above) exits, assignment area No. 3 (or above) will be assigned to area No. 2(or after) when area No.2 is deleted.
- **Select input and output, tag name, total size and RPI, click "delete assignment area" button, and all the selected tag settings in assignment area will be deleted.**
- **Select the cell of product name (IP address), project name and comments, click the "delete tag" button, and all the assignment areas of the selected scanner's tag settings will be deleted.**

Connection Setting View

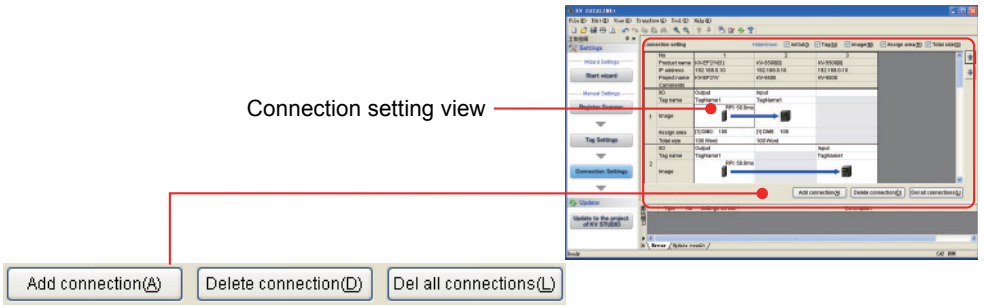
"View(V)" ▶ "Setup connection(3)" Alt + 3

■ Content displayed in the connection setting view

Connections between scanners are displayed in the "Setup connection" view. Do not use setup "wizard" and apply the "Setup connection" view to add, delete and change connections.

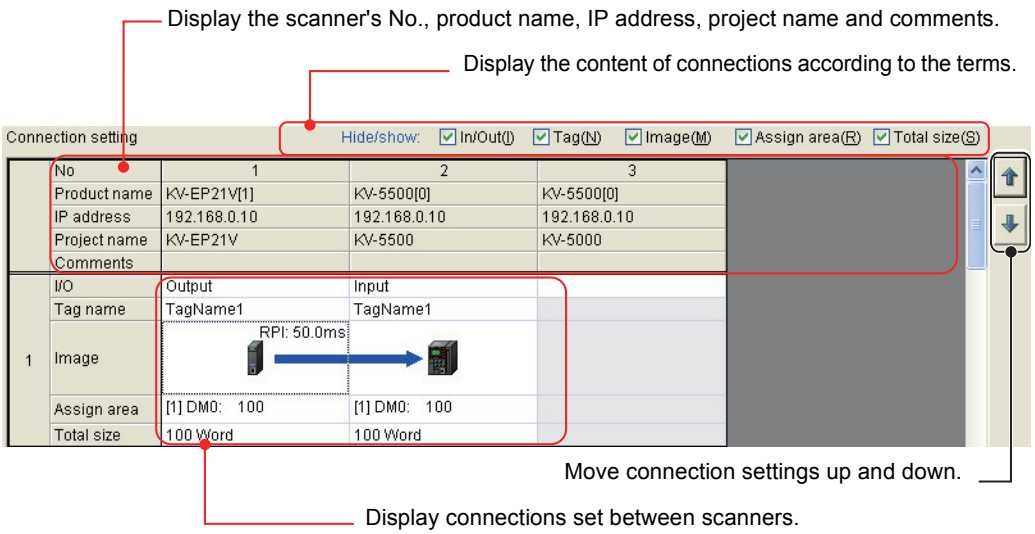
1 Click the "Setup connection" button in the workspace.

The "Setup connection" view will prompt.



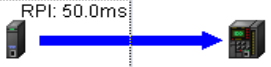
Achieve the functions of add/delete/delete all connections through buttons.

● Display connection settings



● Display connection between scanners.

Connections set between scanners are displayed by images (arrows) showing the direction of data send/receive.

	No	1	2
	Product name	KV-EP21V[1]	KV-5500[0]
	IP address	192.168.0.10	192.168.0.10
	Project name	KV-EP21V	KV-5500
	Comments		
1	I/O	Output	Input
	Tag name	TagName1	TagName1
	Image	RPI: 50.0ms 	
	Assign area	[1] DM0: 100	[1] DM0: 100
	Total size	100 Word	100 Word

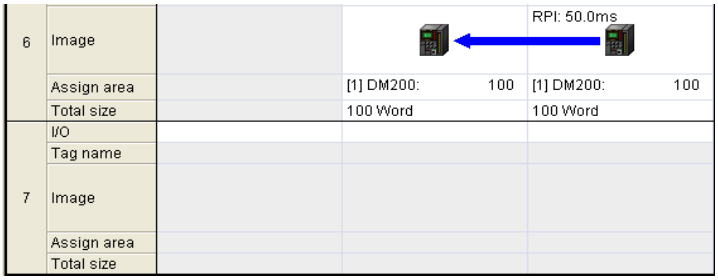
Item	Description
I/O	The input and output setting tag in connection setting. Input: tag setting for receiving data from other scanners. Output: tag setting for sending data from other scanners.
tag name	Show the tag name of selected tag setting. The tag settings can also be changed.
Image (RPI)	Show RPI (communication period). RPI can also be changed. "Change RPI", page 6-31
Image (arrow)	Arrows show the direction of data transmission. Arrows are red if the data are not the same.
Assignment area	If the scanner is from KEYENCE, leading address and data of the assignment area assigned by the tag name are displayed. Assignment area can also be changed.
Total size	Display the total size of assignment in tag setting. The total size can also be changed.

■ Add connections

Provide instructions on how to add connection settings by "connection setting" view.

1 Click the "add connection" button.

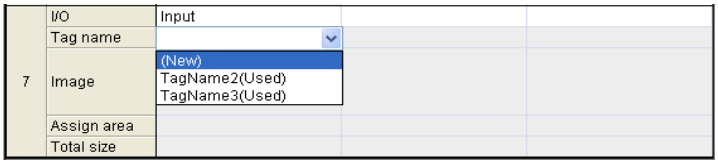
Areas will be added for connection setting.



2 The "input/output" setting of scanners at the receiving end is set as "input".



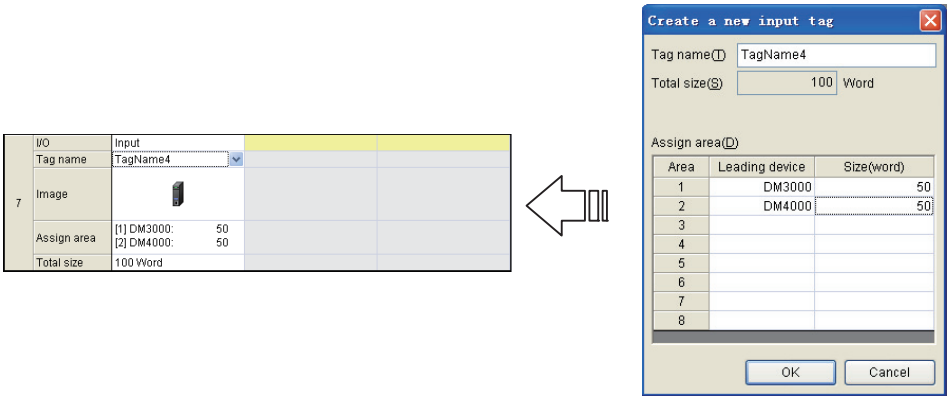
3 Select from dropdown menu of the tag name at the input end of scanner



After selecting "(new)", a "create a new input tag" dialog box will prompt.

"Change/create new tag name", page 6-30

4 Enter the tag name and assignment area, and click the "OK" button.



The tag name and assignment area of the setting tag at the input end of scanner

Meanwhile, the background color of the input and output setting of other scanners is yellow.

5 The "input/output" setting of scanners at the sending end is set as "output".

	I/O	Input	Output
7	Tag name	TagName4	
	Image		
	Assign area	[1] DM3000: 50 [2] DM4000: 50	
	Total size	100 Word	

6 Set the tag name of scanner at the output end.

Set the tag name and set the assignment area and its size the same with input end.

If the total size of "input" is not the same with "output", blue arrow is applied to show the data send/ receive direction.

	I/O	Input	Output
7	Tag name	TagName4	TagName4
	Image		RPI: 50.0ms
	Assign area	[1] DM3000: 50 [2] DM4000: 50	[1] DM2000: 100
	Total size	100 Word	100 Word

Point

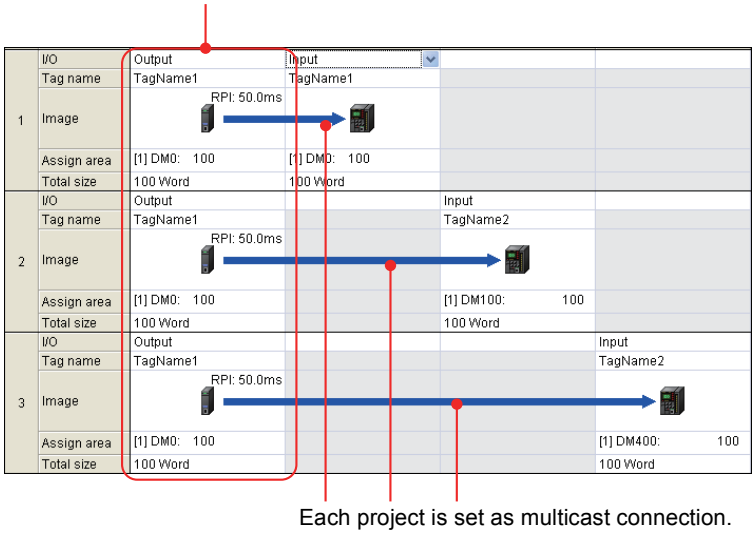
If the total size of "input" is not the same with "output", red arrow is applied for indication.

	I/O	Input	Output
7	Tag name	TagName4	TagName4
	Image		RPI: 50.0ms
	Assign area	[1] DM3000: 50 [2] DM4000: 50	[1] DM2000: 100 [2] DM500: 50
	Total size	100 Word	150 Word

■ Connection settings for multiple scanners receiving the same output data

Multiple scanners can be set to simultaneously receive tag setting (output) data. When updated to each project of "KV STUDIO", connection settings are all set as multicast.

The same tag setting (output) may be applied to connect multiple scanners.



Each project is set as multicast connection.

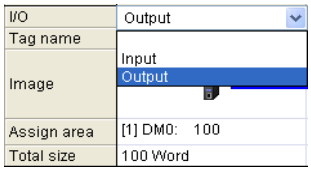
For multicast, see "Connection type", page 4-31.

■ Change connection setting

Provide instructions on how to change connection setting by "connection setting" view.

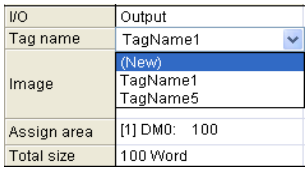
● Change input and output

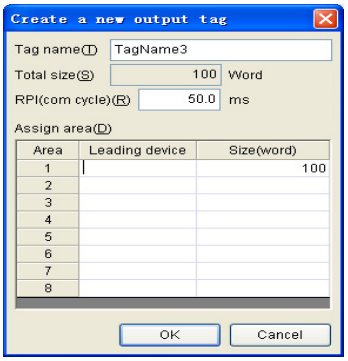
Select the cell of input and output from the dropdown menu



● Change/create new tag name

Select the cell of tag name from the dropdown menu
Display in the menu the tag name that has already been set
When the selection is to create a new tag, the "create a new input tag"/"create a new output tag" dialog box will prompt.

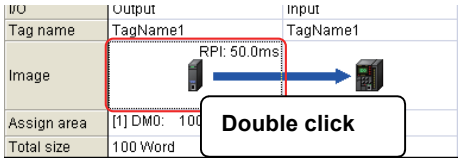


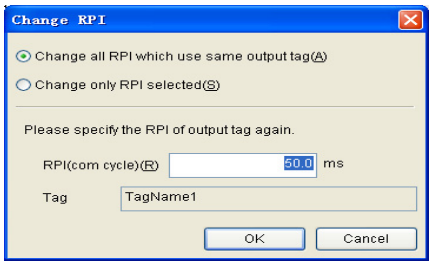


Item		Description
tag name		Display the name of the tag which is to be created. The tag name can also be changed.
Total size		Display the total size. In case of KEYENCE scanner, display the total data size set in the assignment area. In case of scanners from other companies, enter the size of data.
RPI		Display in the newly created output tag setting. RPI can also be changed.
Assignment area(area 1 to 8)		Enter in case of KEYENCE scanner
	Leading device	Enter the leading device which needs assignment and its size in each area
	Size (word)	Setting range: 1 to 724 (the total size of area 1 to 8)

● Change RPI

Double click the image cell to change RPI (communication period), or click the Enter key and change RPI in the coming "change RPI" dialog box.



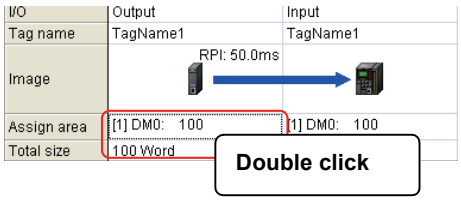


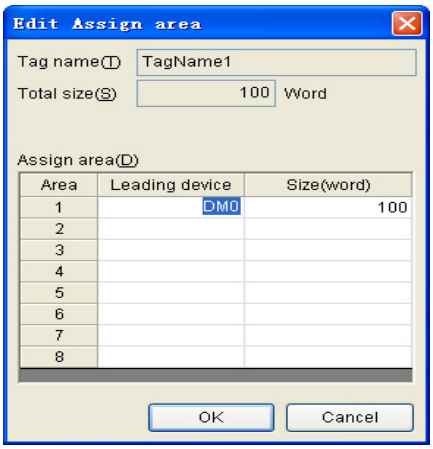
Item	Description
Change all the RPI of connections with the same output tag	Change in batch RPI of other connection settings in selected output tag
Only change the selected connection RPI	Only change the RPI of selected connection setting

Reference It is also available to select "change RPI" from the right-click menu

● Change the assignment area/total size

Double click the cell of assignment area or total size to change assignment area/total size or click the Enter key and change in the coming "edit assignment area" dialog box.





Item		Description
tag name		Display tag name.
Total size		Display the total size. In case of KEYENCE scanner, display the total data size set in the assignment area. In case of scanners from other companies, enter the size of data.
Assignment area(area 1 to 8)		Enter in case of KEYENCE scanner
	Leading device	Enter in each area the initial address and the data value that are in need of assignment Setting range: 1 to 724 (the total size of area 1 to 8)
	Size (word)	

Reference It is also feasible to right click and select "edit assignment area" from the menu

■ Sort connection settings

Apply the right-click menu to sort connection settings

After deciding a scanner as the basic sorting standard, select "connection sorting" ▶ (conditions of sorting) from the right-click menu, and sort the list of connection setting.

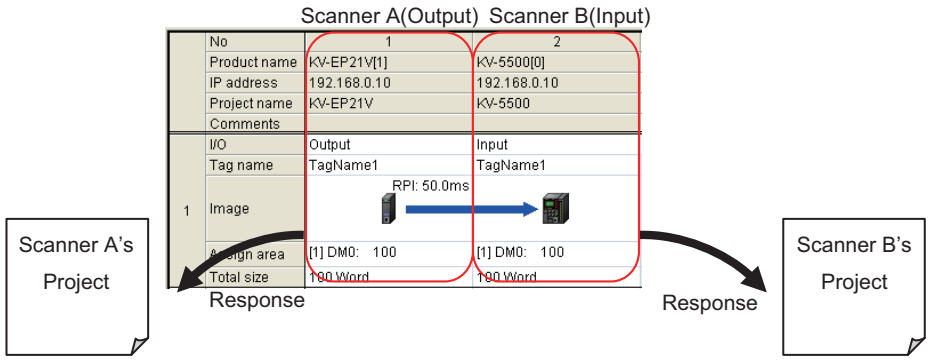
Conditions of sorting

Input and output (input -> output)/input and output (output -> input)/ tag name(ascending sequence)/ tag name (descending sequence)/total size (ascending sequence)/ total size (descending sequence)/ connect target scanner No. (ascending sequence)/connect target scanner No. (descending sequence)/RPI (ascending sequence)/RPI (descending sequence)

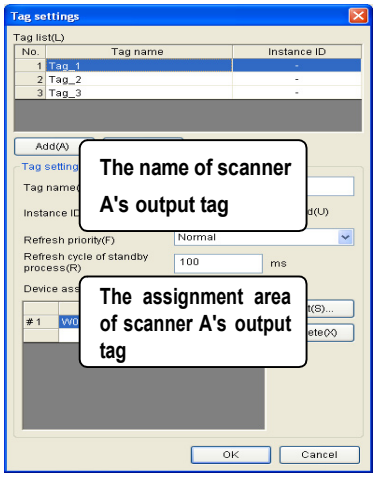
Connection Settings Updated to the KV STUDIO Project

When updating data in "KV DATALINK+ for EtherNet/IP" to "KV-EP21V (EtherNet/IP setting)" in "KV STUDIO" explanations about changed settings should be provided.

Connection of "KV DATALINK+ for EtherNet/IP"



- update the IP address (change)
- Update (add) to tag setting

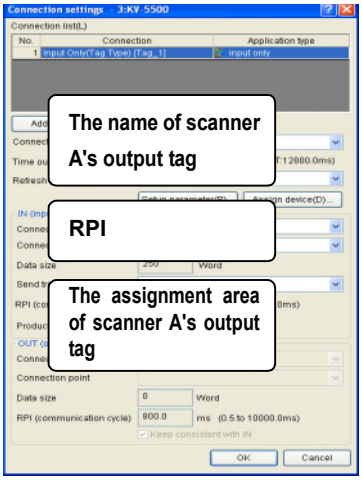


Because the connection is started from scanner B, the name of output tag and the assignment area of output tag are updated to tag setting

Start connection

Data

- Add scanner A to the scan list
- update the IP address (change)
- Update (add) to tag setting



Because the connection is linked with scanner A, the name of output tag, RPI and the assignment area of input tag are updated to the connection setting.
Meanwhile, scanner A will be added to the target end in the scan list.

Reference

- Multicast connection will be set for scanner A. (The connection setting is always set as multicast.)
- Do not use the name of scanner B's input tag.

6-7 Update to the KV STUDIO Project

As for the data connection set in "KV DATALINK+ for EtherNet/IP", provide instructions in the way of updating data to "KV STUDIO" project.

Update to the KV STUDIO Project

"Transform(G)" ▶ "update to the project of KV STUDIO(P)"

Apply the data connection set in KEYENCE scanner, and directly update to "KV STUDIO" project from "KV DATALINK+ for EtherNet/IP".

Point

- **When updated to KV STUDIO, the project content will be changed. If you want to save projects before updating, save the project under another name.**
- **If updated project is not opened, automatically start "KV STUDIO". The setting data of object project will be changed. Save project after checking the settings of Unit Editor. If errors happen when checking settings, the mistakes will be displayed in the output window. Correct the mistakes.**
- **If updated project has been already opened, the setting data of object project will be changed, but the settings will not be checked and saved. Check and save settings when necessary.**
- **When updated to the project, the connection setting is always set as multicast. To change the connection type, each project must be changed.**

1 Click the "update to the project of KV STUDIO" button in the workspace.

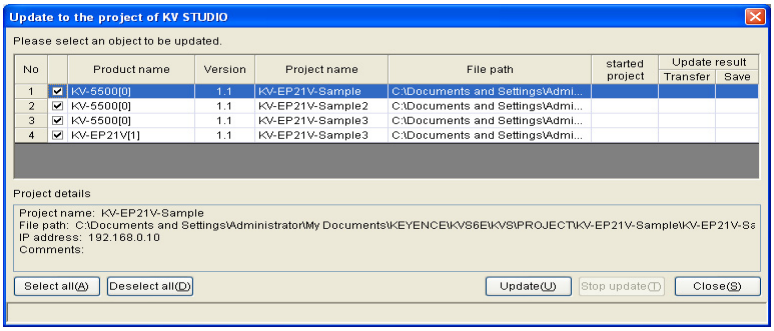
Display "update to the project of KV STUDIO" dialog box.

Reference

If the setting is wrong, display the mistakes in the output window.
Remove the errors and implement again.

"Output window " (page 6-44)

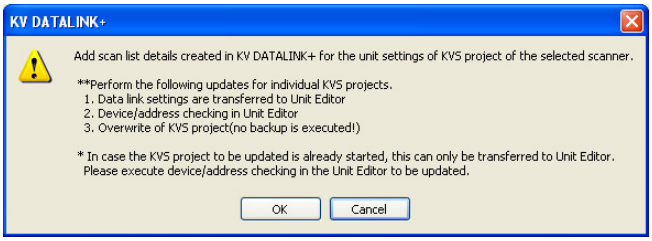
2 Select the KEYENCE scanner to be updated and click the "update" button.



Item		Description
No		Display the scanner No., product name, revision, project name and file path. The selected project is named as updated object.
(check box)		
Product name		
Version		
Project name		
File path		
started project		If the selected project in "KV STUDIO" is opened on PC, display the image "*".
Update result	Transfer	When updating is being implemented, display the project's updating status. (green): Project is updated normally. (orange): Project fails to be updated. Reference Check the results at the "updating results" tab in output window.
	Save	When updating is being implemented, display whether the project is saved after being updated. (green): Project is saved normally. (orange): Project fails to be saved. --- Project is opened but fails to be saved. Reference Check the results at the "updating results" tab in output window.
Profect details		Display project name and file path of selected project, and scanner's IP address and comments.
"select all"*		Select all scanners from KEYENCE.
"Unselect all"*		Unselect all scanners.
"Update"		Update the project in "KV STUDIO".
"stop update"		"KV STUDIO" project that stops updating in the midway. As for the "KV STUDIO" project that is being started, the status is midway updating. As for the "KV STUDIO" project that is started internally, exit without saving updated content and return to the status before updating

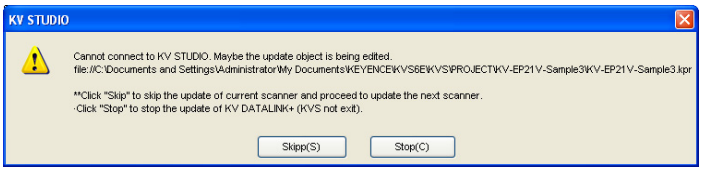
* When the target project is the next one, do not display this item

3 Display the following dialog box, click "OK", and then implement updating



● Alarm occurs in the updating process

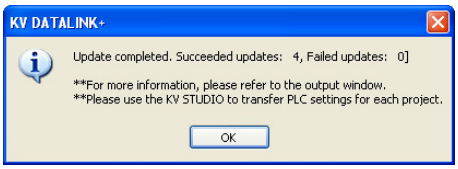
When an Alarm occurs in the updating process, display the following information.

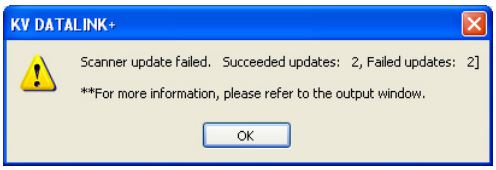


When "termination" is selected, stop updating. "KV STUDIO" also stops at the starting status.
When "skip" is selected, stop updating project with warnings and continue updating other projects.

4 When the updating is completed, display completion information.

If the updating fails, confirm the contents shown in output window.





File

Various functions in "File(F)" menu are described.

New


"File(F)" ▶ "New(N) " Ctrl **+** N

Select "file(F)" ▶ "New(N)" from the menu.
Create a KV DATALINK+ setting file.

Reference Execute the creation when "KV DATALINK+ for EtherNet/IP" starts.

Open


"File(F)" ▶ "New(O) " Ctrl **+** O

Select "File(F)" ▶ "Open(O)" from the menu, execute existing KV DATALINK+ setting file. Display dialog box of the "Open file".

Close

"File(F)" ▶ Close(C)

Select "File(F)" ▶ "Close(C)" from the menu, close the currently opened KV DATALINK+ setting file.

Save


"File(F)" ▶ "Save(S) " Ctrl **+** S

Select "File(F)" ▶ "Save(S)" from the menu, save the KV DATALINK+ setting file that is currently being edited.

Save as

"File(F)" ▶ Save as(A)

Select "File(F)" ▶ "Save as(A)" from the menu, rename and save currently opened KV DATALINK+ setting file.

Export support setting information

"File(F)" ▶ Export setup auxiliary information(E)

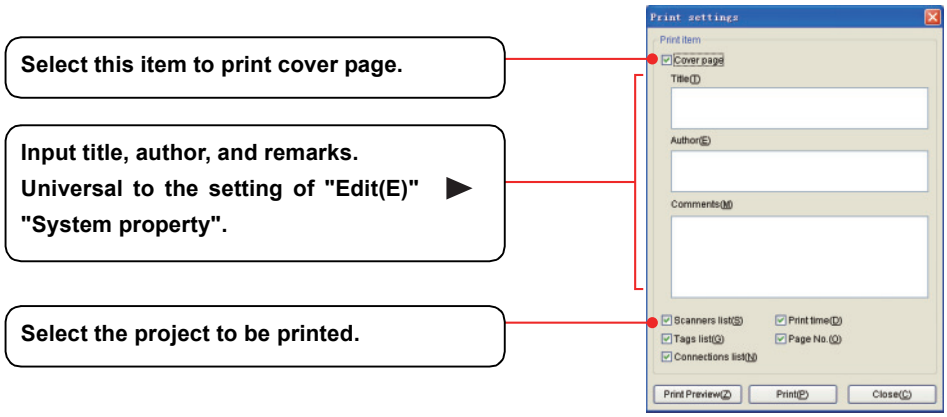
Save the setting of scanner from other companies as support setting information file.
Select "File(F)" ▶ "Export setup auxiliary information(E)" from the menu.
Display "export support setting information" dialog box, then select the scanner to export setting, create support setting information file.
Used for setting data link of the scanner from other companies.

Print

"File(F)" ▶ "print(P)" Ctrl + P

1 Select "file(F)" ▶ "Print (P)" from the menu.

Display "Print Setting" dialog box.

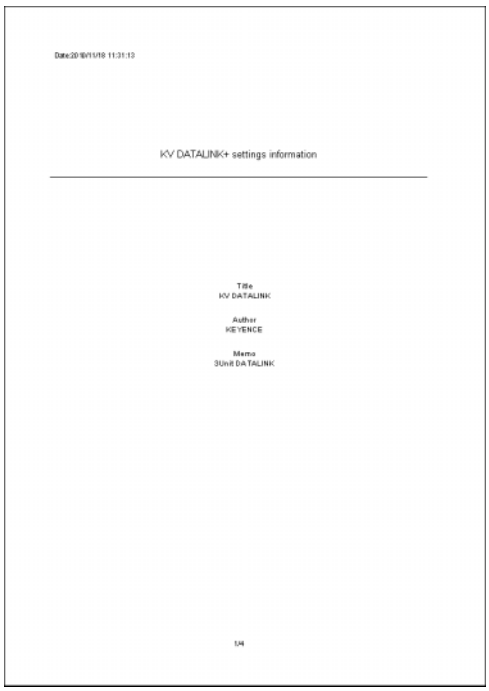


2 **Click "print" button to display "Print" dialog box.**

Click"OK" button of the "Print" dialog box, begin to print.

Reference Click "Print preview" button to display print preview.

Point **After change the setting, click "Close" button to save the changes.**


Date:2018/11/18 11:31:13

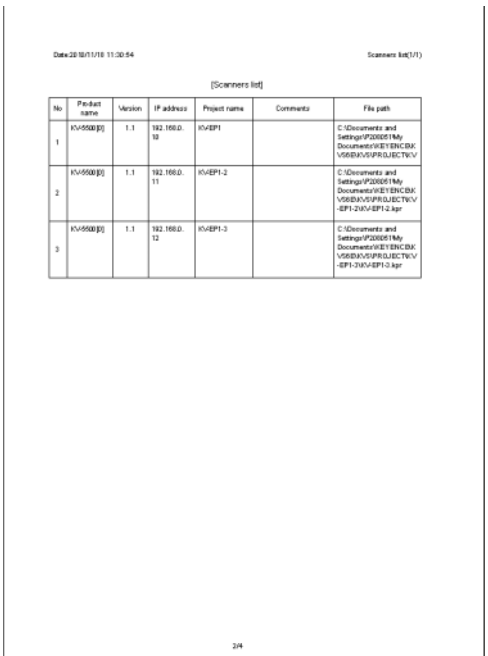
KV DATALINK+ settings information

Title
KV DATALINK

Author
KEYENCE

Memo
3Unit DATALINK

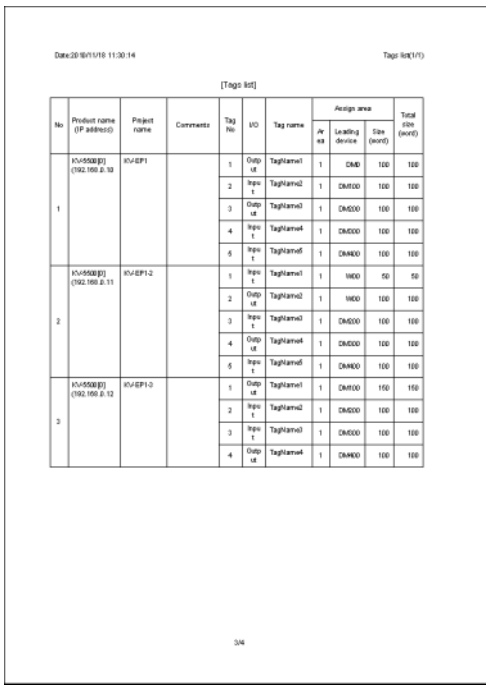
1/4


Date:2018/11/18 11:30:54 Scanners list(1/1)

[Scanners list]

No	Pre-Set name	Version	IP address	Project name	Comments	File path
1	KV-5500[0]	1.1	192.168.0.10	KV-EP1		C:\Documents and Settings\P2000518\My Documents\KEYENCE\KV5\PROJECT\KV
2	KV-5500[0]	1.1	192.168.0.11	KV-EP1-2		C:\Documents and Settings\P2000518\My Documents\KEYENCE\KV5\PROJECT\KV-EP1-2\KV-EP1-2.kpr
3	KV-5500[0]	1.1	192.168.0.12	KV-EP1-3		C:\Documents and Settings\P2000518\My Documents\KEYENCE\KV5\PROJECT\KV-EP1-3\KV-EP1-3.kpr

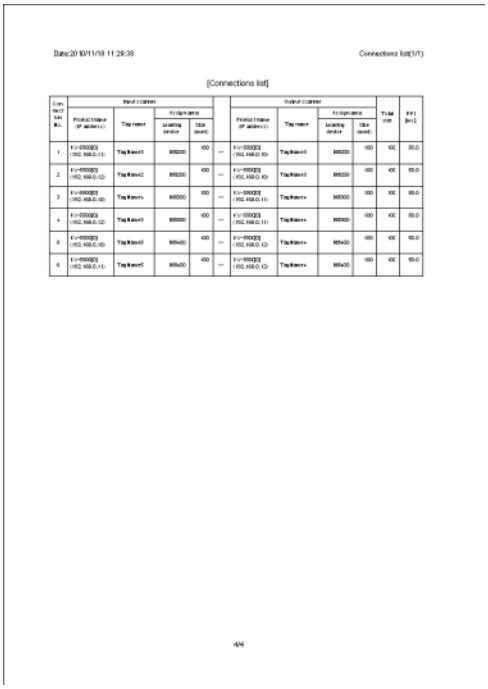
2/4


Date:2018/11/18 11:30:14 Tags list(1/1)

[Tags list]

No	Product name (IP address)	Project name	Comments	Tag No	I/O	Tag name	Assign area			Total size (word)
							Area	Leading device	Size (word)	
1	KV-5500[0] (192.168.0.10)	KV-EP1		1	Output	TagName1	1	DM0	100	100
				2	Input	TagName2	1	DM100	100	100
				3	Output	TagName3	1	DM200	100	100
				4	Input	TagName4	1	DM300	100	100
				5	Input	TagName5	1	DM400	100	100
2	KV-5500[0] (192.168.0.11)	KV-EP1-2		1	Input	TagName1	1	W00	50	50
				2	Output	TagName2	1	W00	100	100
				3	Input	TagName3	1	DM200	100	100
				4	Output	TagName4	1	DM300	100	100
				5	Input	TagName5	1	DM400	100	100
3	KV-5500[0] (192.168.0.12)	KV-EP1-3		1	Output	TagName1	1	DM100	150	150
				2	Input	TagName2	1	DM200	100	100
				3	Input	TagName3	1	DM300	100	100
				4	Output	TagName4	1	DM400	100	100

3/4


Date:2018/11/18 11:29:38 Connections list(1/1)

[Connections list]

Conn ect ion No.	Input scanner				Output scanner				Total size	RPI [ms]
	Product name (IP address)	Tag name	Assignment area: Leading device	Assignment area: Size (word)	Product name (IP address)	Tag name	Assignment area: Leading device	Assignment area: Size (word)		
1	KV-5500[0] (192.168.0.11)	TagName3	W0200	100	KV-5500[0] (192.168.0.10)	TagName3	W0200	100	KK	50.0
2	KV-5500[0] (192.168.0.12)	TagName2	W0200	100	KV-5500[0] (192.168.0.10)	TagName3	W0200	100	KK	50.0
3	KV-5500[0] (192.168.0.10)	TagName4	W0300	100	KV-5500[0] (192.168.0.11)	TagName4	W0300	100	KK	50.0
4	KV-5500[0] (192.168.0.12)	TagName3	W0300	100	KV-5500[0] (192.168.0.11)	TagName4	W0300	100	KK	50.0
5	KV-5500[0] (192.168.0.10)	TagName5	W0400	100	KV-5500[0] (192.168.0.12)	TagName4	W0400	100	KK	50.0
6	KV-5500[0] (192.168.0.11)	TagName5	W0400	100	KV-5500[0] (192.168.0.12)	TagName5	W0400	100	KK	50.0

4/4

Print preview

 **"File(F)" ▶ "Print Preview(V) "**

1 Select "file(F)" ▶ "Print preview(V)" from the menu.

Display print preview.

Printer setting

"File(F)" ▶ "Printer Setting(R)"

Set the print paper size, portrait or landscape print direction etc.

Point

Display content varies with different printers. For the setting method, see operating instructions of the printer.

Edit

Various functions in "Edit(E)" menu are described.

Undo


"Edit(E)" ▶ "Undo(U)" Ctrl + Z

Undo the last operation, and restore to original status.
Restorable operation is as follows.
Data link setting in the setup wizard/edit content in the "Registered scanner" view
Edit content in the "Tag setting" view/edit content in the "Connection setting" view

Reference When undo is impossible, menu item and toolbar are displayed in gray, cannot be selected.

Restore


"Edit(E)" ▶ "Restore(R)" Ctrl + Y

Restore the undone operation in "Undo(U)".

Reference When cannot be restored, menu item and toolbar are displayed in gray, cannot be selected.

Cut/copy/paste

"Edit(E)" ▶ "Cut(T)" Ctrl + X


"Edit(E)" ▶ "Copy(C)" Ctrl + C


"Edit(E)" ▶ "Paste(R)" Ctrl + V

Cut, copy or paste the content of the selected cell.

Reference When unable to cut or copy, menu item and toolbar are displayed in gray, cannot be selected.

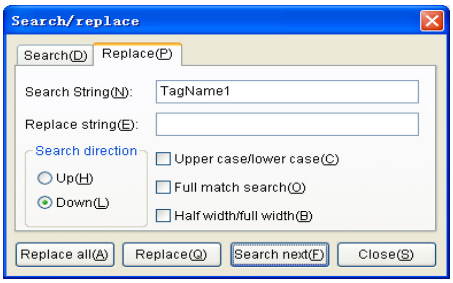
Find/Replace

"Edit(E)" ▶ "Find(F)" Ctrl + F

▶ "Replace(E)" Ctrl + H

Display "Tag setting" view, find/replace the content of each project.

Select "Edit(E)" ▶ "Find(F)"/"Replace(E)" from the menu, display "Find/Replace" dialog box.



Point

Only tag name and leading device can be replaced.

Item	Description
Search String	Find: input the character string to be found. Replace: input the character string before replacement.
Replace string *	Input the character string after replacement.
up	Execute find/replace from the current cursor position upwards.
down	Execute find/replace from the current cursor position downwards.
Upper case/lower case	When case-sensitive is selected, it is case-sensitive in the find/replace process.
Full match search	When this item is selected, only find/replace the project completely matched with the input character.
Half width/full width	When this item is selected, half-width characters and full-width characters are differentiated in the find/replace process.
"Replace all"*	Replace all target character strings in the specified range.
"Replace" *	Replace target character strings in the specified range separately.
"Search next"	Execute find according to the specified find direction. Do not execute replace.
"Close"	Close the "Find/Replace" dialog box.

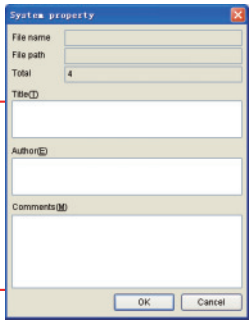
* It will display only when replace is selected.

System property

"Edit(E)" ▶ "System property(S)"

Display attribute of KV DATALINK+ setting file.
Title, author, comments can be set.

Input title, author, and remarks.



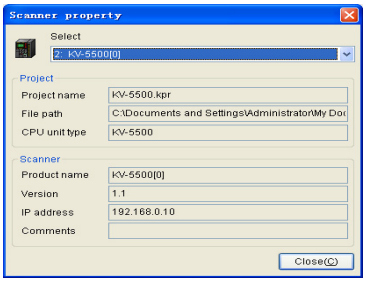
Other procedure Select "system attribute" from the right-click menu.

Scanner property

"Edit(E)" ▶ "Scanner property(N)"

Display scanner attribute.

Other procedure Select "Scanner property" from the right-click menu.



Reference When scanner is rack configuration unit, display "Rack configuration" button, click to display "Rack configuration" dialog box.

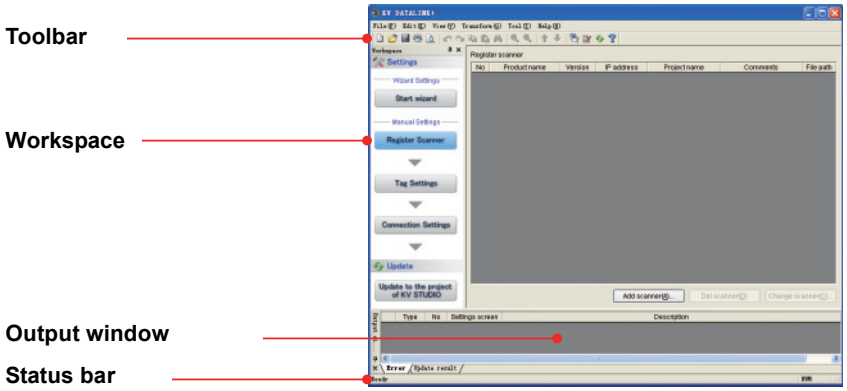
View

Various functions in "View(V)" menu are described.

toolbar/status bar/workspace/output window

"View(V)" ▶ **"Toolbar(T)"**
▶ **"Status bar(S)"**
▶ **"Workspace(4)"** Alt + 4
▶ **"Output window(5)"** Alt + 5

Select each project from the menu, switch display/hide. Switch display and hide upon each click.
When check mark is available : display
When check mark is unavailable : hide



Register scanner, Tag setting, Connection setting

"View(V)" ▶ **"Register scanner(1)"** Alt + 1
▶ **"Tag setting (2)"** Alt + 2
▶ **"Connection setting(3)"** Alt + 3

Select each project from the menu, switch the display content of setup screen to "Register scanner" view, "Tag setting" view, "Connection setting" view.

Zoom in/zoom out/specify multiplying factor

"View(V)" ▶ "Zoom in(E)" Ctrl **+** PageUp

"View(V)" ▶ "Zoom out(R)" Ctrl **+** PageDown

"View(V)" ▶ "Specify multiplication(Z)" ▶ "200% (1)"/"150% (2)"/"100% (3)"/"75% (4)"/"50% (5)"/"25% (6)"

Change display size of "Connection setting" view.

Select"View(V)" ▶ "Zoom in(E)" or "Zoom out(R)" from the menu, amplification/reduced display. Or select "View(V)" ▶ "Specify multiplication(Z)", specify to display multiplying factor directly.

Reference Ctrl Press on Ctrl and roll mouse simultaneously to zoom in/out the display size.

Split screen

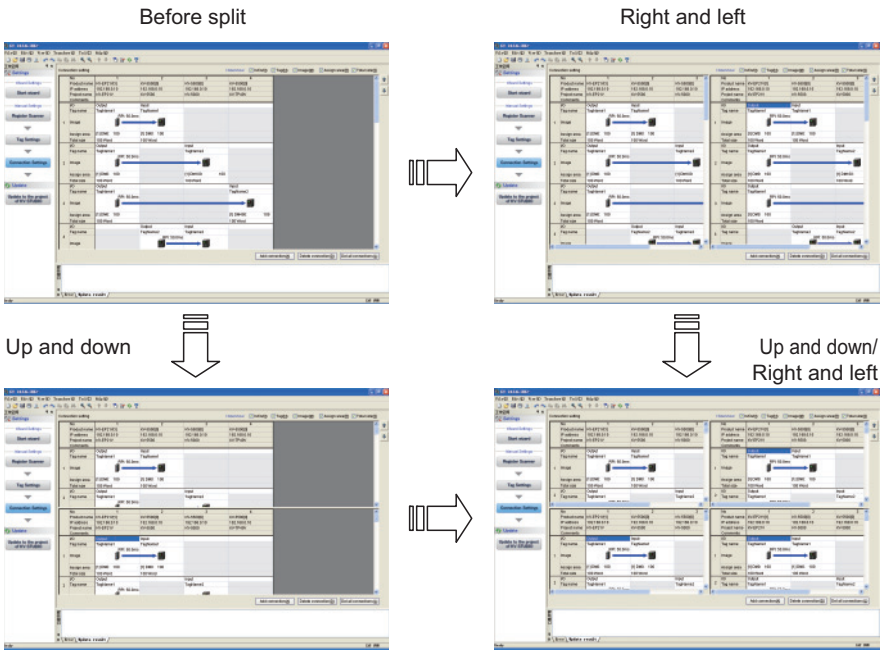
"View(V)" ▶ "Split screen(P)" ▶ "Up and down(V)"

"Splitscreen(P)" ▶ "Right and left(H)"

setup screen for partitioning "Connection setting" view.

Perform vertical/horizontal splitting via the menu "View(V)" ▶ "Split screen(P)" ▶ "Up and down(V)"/"Right and left(H)".

Switch split screen upon each click.



Scanner moves upwards/scanner moves downwards



"View(V)" ▶ "Move scanner up(U)" Ctrl + U



"View(V)" ▶ "Move scanner down(D)" Ctrl + D

When "Registered scanner" view, "Tag setting" view are displayed, move the selected scanner up and down. Registration No of the scanner is also changed.

When a scanner is selected, select "View(V)" ▶ "Move scanner up(U)"/"Move scanner down(D)" from the menu, the scanner moves upwards/downwards.

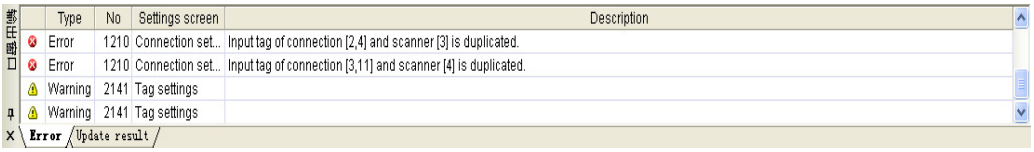
Transition

Various functions in "Transform(G)" menu are described.

Matching check

"Transform(G)" ▶ "Integration Check(C)" Ctrl + K

Check whether error exists in the setting data.
Select "Transform(G)" ▶ "Integration Check(C)" from the menu, "Error" tab in the "Output" window shows the check result.



Item	Description
(empty column)	Icon is used to display the check result. (red): error/ (yellow): warning/ : no error
Type	Display the check result. Error : error exists in the setting data, setting data cannot work normally. Example) duplicate IP address is set in the scanner. Warning : setting data of normal operation, but incomplete. Example) contains unused Tag setting.
No	In case of error, warning, display No. according to the content.
Settings screen	Name of the setting view where error, warning occurred is displayed.
Description	Display content of the error, warning.

● Jump to the corresponding error location

Double click the error, warning line in output window, or select from the right-click menu (jump to the corresponding error line), cursor moves to the setting item where error, warning occurred. Enter key may also be used to jump.

Update to the KV STUDIO project.

"Transform(G)" ▶ "Update to the project of KV STUDIO(P)"

Apply the data connection set in KEYENCE scanner, and directly update to "KV STUDIO" project from "KV DATALINK+ for EtherNet/IP".

For project updated to "KV STUDIO", see "6-7 Update to the KV STUDIO Project", page 6-34.

Tool

Various functions in "Tool(T)" menu are described.

Start wizard

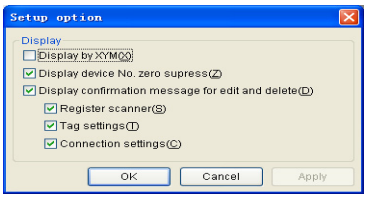
"Tool(T)" ▶ "Start wizard(W)" Ctrl + W

Select "Transition(T)" ▶ "Start wizard(w)" from the menu, display "Setting Wizard" dialog box.
For how to operate the setup wizard, see "6-5 How to Operate Setup Wizard", page 6-11.

Option

"Tool(T)" ▶ "Option(O)"

Set options related with the setting and display of "KV DATALINK+ for EtherNet/IP".
Select "Tool(T)" ▶ "Option(o)" from the menu, display "Option Setting" dialog box.



Item		Description
Displayed by XYM		Device name is displayed in the form of XYM.
Display device No.zero supress		Zero suppression for the displayed device No.. Example) no zero suppression: R00500 zero suppression: R500
Display confirmation message for edit and delete		Select this item, edit, delete project in "Registered Scanner", "Tag setting", "Connection setting" views, display acknowledgment message.
	Register scanner	
	tag setting	
	Connection settings	

Help

Various functions in "Help(H)" menu are described.

User's manual

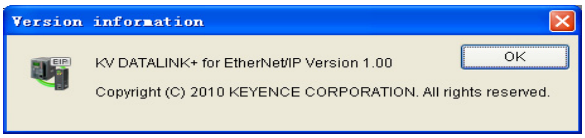
"Help(H)" ▶ "User's manual(M)" F1

Select "Help(H)" ▶ "User's manual(m)" from the menu, display PDF manual.

Version information

"Help(H)" ▶ "Version information (A)"

Select "Help(H)" ▶ "Version information(A)" from the menu, display "Version Information" dialog box.



MEMO

7

SENSOR APPLICATION

This chapter describes the operating principle and function of sensor application function, as well as necessary settings.

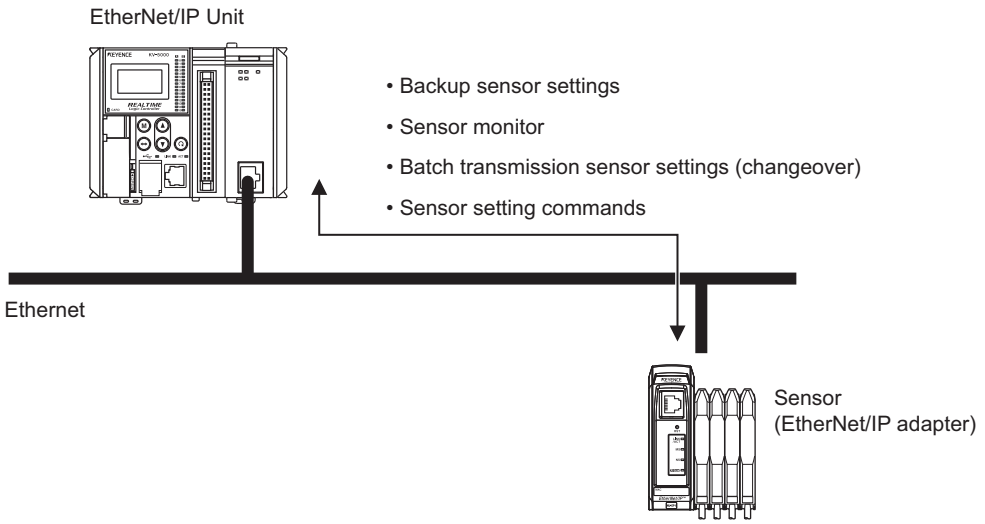
7-1 Sensor Application Function. 7-2
7-2 Procedures of Sensor Application Setting 7-3
7-3 Common Contents of Sensor Application 7-4
7-4 Backup Sensor Settings. 7-7
7-5 Sensor Monitor. 7-41
7-6 Batch Transmission Sensor Settings 7-48
7-7 Sensor Setting Commands 7-71
7-8 Complete Code 7-96
7-9 Appendix 7-103

7-1 Sensor Application Function

This section gives a general description on sensor application function.

Overview

The sensor application function enables to backup and change settings, as well as monitor operation status of the sensor (EtherNet/IP adapter) in the scan list of EtherNet/IP Setting with simple settings and operations. Furthermore, explicit messages (client) program is not required.
The sensor application includes the functions of backup sensor settings, sensor monitor, batch transmission sensor settings, and sensor setting commands.



Point

Sensor application is available for the sensor registered in the scan list of EtherNet/IP Setting.

"7-4 Backup Sensor Settings", page 7-7
"7-5 Sensor Monitor", page 7-41
"7-6 Batch Transmission Sensor Settings", page 7-48
"7-7 Sensor Setting Commands", page 7-71

7-2 Procedures of Sensor Application Setting

This section describes the procedures to set up sensor application.

Procedures of Sensor Application Setting

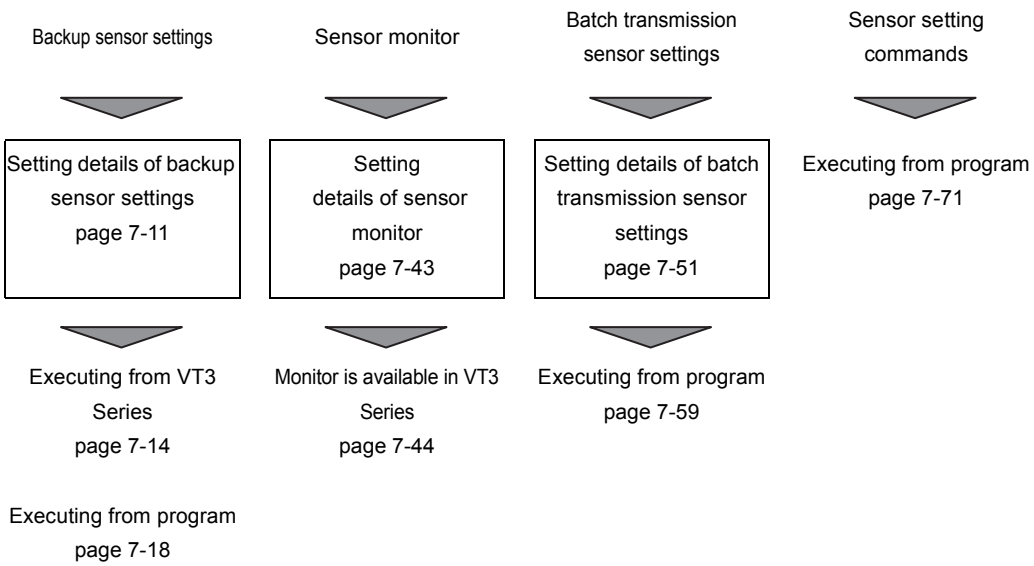
Unit Installation.
Connect the EtherNet/IP Unit and the required EtherNet/IP Device to the Ethernet.

EtherNet/IP Unit setting, KV STUDIO Unit Editor
Execute EtherNet/IP Unit setting in Unit Editor.

"Settings in Unit Editor Related to Sensor Application", page 7-4

Scan list setting EtherNet/IP setting of KV STUDIO.
Register the sensor (adapter) connected via EtherNet/IP Setting to the scan list.
This step also applies to cyclic (I/O) messages.
The sensor application enables to execute the functions using the specified node address and slot No. (rack configuration unit) in the scan list.

"Scan List Settings", page 4-12



7-3 Common Contents of Sensor Application

This section describes common contents of sensor application.

Settings in Unit Editor Related to Sensor Application

The settings in Unit Editor of KV STUDIO related to sensor application.
Please set up appropriate value for other setting items in "Basic" of Unit Editor as required.
"Setting Item List", page 3-4

Unit Editor Setting

Item	Setting range	Default value	See page
"Basic"			
Leading DM No.	0 to 65304 (0 to 32538 for KV-NC1EP)	To be set	3-6
Leading relay No. (ch unit setting)	10 to 960 (10 to 560 for KV-NC1EP)	To be set	3-6
Baud rate	"100/10Mbps automatic"/"10Mbps"	100/10Mbps automatic	3-6
Setting method of IP address	Fixed IP address/ BOOTP/Fixed IP auto switching/BOOTP	Fixed IP address	3-6
IP address	(0 to 255).(0 to 255).(0 to 255).(0 to 255)	192.168.0.10	3-7
Subnet mask	(0 to 255).(0 to 255).(0 to 255).(0 to 255)	255.255.255.0	3-7
EtherNet/IP Setting			
Explicit messages time out [ms]*	10 to 65530	10000	3-12

* It is used to set up the time out value of explicit messages when executing sensor application function.

Simultaneous Execution of Sensor Application Functions

Each sensor application function uses EtherNet/IP Unit explicit messages (client) functions internally. Therefore, when the same node address (IP address) receives multiple function execution requests, such as sensor application and explicit messages (client), processing will be kept according to the sequence of request. When the processing that is being executed ends, the kept processing is executed based on receiving sequence. In this way, the time from execution request to completion will change depending on the execution status of functions.

Compatibility Check for Sensor Application

Sensor application enables to check if the units are compatible by reading the information of the sensor actually connected and comparing it with the settings registered in the scan list. Compatibility check can be set up for each sensor in "Unit setting" tab of EtherNet/IP Setting.
Compatibility check error occurs in case of incorrect check result.
""Unit Setting" Tab", page 5-22

Point

When executing restore sensor settings of backup sensor settings function, compatibility check should be executed for the information of sensor registered in the scan list and the information stored in the backup sensor settings file.

● Setting items of compatibility check

Item	Description
Check model consistency	Check if the setting is the same as vendor ID, device type, product code and major revision of the actual machine
Check model compatibility	This item is displayed if adapter from KEYENCE is selected. Check if the setting is the same as vendor ID, device type, product code of the actual machine, as well as major revision (setting) <= major revision (actual machine).
Check Series compatibility *	This item is displayed if adapter from KEYENCE is provided with Series code and Series version. Check whether the setting is consistent with vendor ID, device type, and Series code of real machine, and Series version (setting) <= Series version (real machine).
Not check	Do not execute compatibility check.

* If "Check Series compatibility" is selected, the product code and major revision will not be checked.

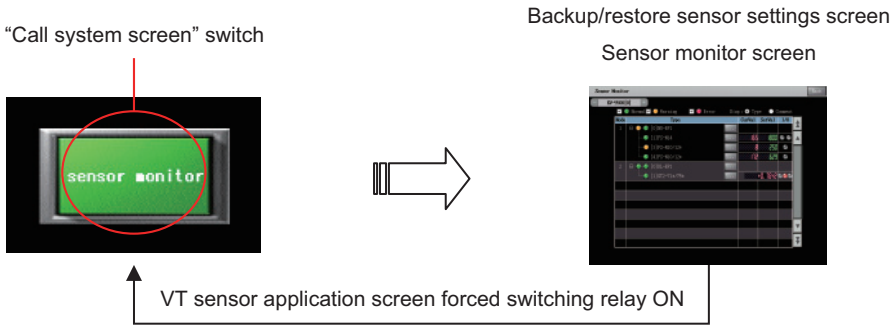
Point

- **Compatibility check of the sensor application is independent of the compatibility check of cyclic (I/O) messages. Therefore, depending on the contents of compatibility check, sensor application functions may be executed for error sensors during compatibility check of cyclic (I/O) messages. However, the inactive sensor during cyclic (I/O) messages is not displayed in sensor monitor.**
- **There's no "Follow adapter rules" in the items of compatibility check of sensor application functions.**

VT Sensor Application Screen Forced Switching Relay

When "call system screen" switch of VT3 Series is used to display the screens of backup sensor settings and sensor monitor, if the VT sensor application screen forced switching relay (CR 2313) assigned to CPU unit is ON, it will move to calling screen.

Relay No.	Name	R/W
CR2313	VT sensor application screen forced switching relay	W



Point

- **This relay is enabled if "call system screen" switch is used to display screens of backup sensor settings, restore sensor settings and sensor monitor.**
- **In case the relay is ON, the original screen will be returned by pressing the "call system screen" switch.**

Progress and Log Monitor of Sensor Application Functions

The execution status and log of backup sensor settings and batch transmission sensor settings can be checked in the Unit Monitor of KV STUDIO.

"Chapter 15 MONITOR"

The latest 16 operation logs of backup sensor settings and batch transmission sensor settings will be respectively recorded in CPU unit.

7-4 Backup Sensor Settings

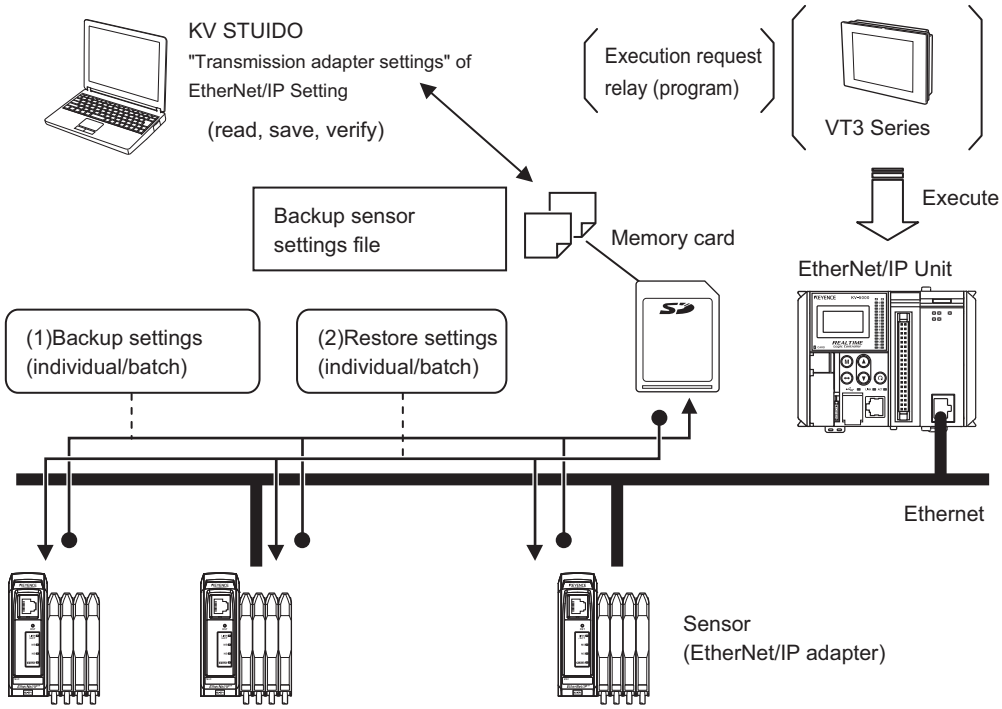
This section describes the details of backup sensor settings, as well as how to use this function.
Backup sensor settings function includes batch backup sensor settings, individual backup sensor settings, batch restore sensor settings and individual restore sensor settings.

Point

KV-NC32T is necessary when using backup sensor settings on the KV-NC1EP.

Overview

The backup sensor settings function includes backup (the settings of multiple sensors registered in the scan list of EtherNet/IP Setting is read and stored in the memory card of CPU unit) and restore (the contents of setting files stored in the memory card is transferred to the sensor (adapter)). Batch backup and restore against sensors (adapters) registered in the scan list, and individual backup and restore against specific sensor (adapter) are available for backup sensor settings.
Backup sensor settings function is executed from the assigned execution request relay or VT3 Series touch panel display from KEYENCE.
Backup sensor settings relates to transmission adapter settings function of EtherNet/IP Setting. Backup sensor settings file can be read/stored/verified with the "Transmission adapter settings" dialog box of EtherNet/IP Setting.
"Transmission Adapter Settings", page 5-56



Point

- **For backup sensor settings function, Get_Attribute_Single service is executed during backup against each sensor (adapter), and Set_Attribute_Single service is executed during restore. (In case of units from KEYENCE, some different services are used)**
- **The sensors and parameters shown in "Transmission adapter settings" dialog box of EtherNet/IP Setting support backup sensor settings function. The set value of parameters with R/W (readable/writable) attribute can be stored and transferred individually.**

● Functions of backup sensor settings

(1) Backup sensor settings (sensor => memory card (backup sensor settings file))

This function enables to backup (store) the settings of multiple sensors (adapters) registered in the scan list in the backup sensor settings file in the memory card of CPU unit. The backup sensor settings function includes batch backup of all sensors (adapters), and individual backup of object sensor specified by node address and slot No.. The object sensor is specified via program or VT3 Series in case of individual backup.

(2) Restore sensor settings (memory card (backup sensor settings file) => sensor)

When configuring multiple units with the same settings or replace some sensors (adapters), this function allows to specify the backup sensor settings file in the memory card of CPU unit, and restore (transfer) the settings of multiple sensors (adapters) registered in the scan list. The backup sensor settings function includes batch restore of all sensors (adapters), and individual restore of object sensor specified by node address and slot No.. The object sensor is specified via program or VT3 Series in case of individual restore.

Reference

Verify sensor settings (backup sensor settings file<=>sensor)

Backup sensor settings file can be read with "Transmission adapter settings" dialog box of EtherNet/IP Setting. The backup sensor settings file read can be verified with the connected sensor (adapter) settings.

The changed settings can be checked immediately after comparison with the backup data.

Verification between backup sensor settings files can also be executed.

"Chapter 5 HOW TO USE EtherNet/IP SETTING"

● Backup sensor settings file

This file is used to store the sensor settings in backup sensor settings function, which is stored in the memory card of CPU unit when executing backup sensor settings.

The file name is defined with EtherNet/IP Setting when executing backup sensor settings.

It can also be created with the "Transmission adapter settings" dialog box of EtherNet/IP Setting.

"Backup Sensor Settings File", page 7-10

● How to execute backup sensor settings

Backup sensor settings can be executed via execution request relay, or VT3 Series touch panel display

Execution with program (execution request relay)

If the execution request relay assigned to the device is ON, the functions of backup sensor settings will be executed against each sensor (adapter).

"Execute Backup Sensor Settings Function from Ladder Program", page 7-18

Execution with VT3 Series

The backup sensor settings function can be executed using the special screen (system mode screen) of backup sensor settings of VT3 Series touch panel display from KEYENCE.

Special settings are not required since the special screen is used.

"Execution of Backup Sensor Settings Function with VT3 Series", page 7-14

Point

It can be used in VT3 Series with program version 4.0 or above, and resolution above VGA.

● Unit-specific command/function related to backup sensor settings

Unit-specific commands/functions for programming are available for backup sensor settings, and specifying buffer memory address assigned is not required.

"Unit-specific Command for Backup Sensor Settings Function", page 7-33

"Unit-specific Function for Backup Sensor Settings Function", page 7-38

● Progress and log monitor of backup sensor settings

The execution status and log of backup sensor settings and batch transmission sensor settings can be checked in the Unit Monitor of KV STUDIO.

"Chapter 15 MONITOR"

Up to 16 operation logs can be recorded in CPU unit for backup sensor settings and batch transmission sensor settings functions respectively from the largest one.

Backup Sensor Settings File

The backup sensor settings file is stored in the memory card of CPU unit.
For the setting of backup sensor settings file, see "Setup backup sensor settings", page 7-12.

Point

KV-NC32T is necessary when using backup sensor settings on the KV-NC1EP.

■ Creation of backup sensor settings file

● Create file by executing backup sensor settings

When executing the backup sensor settings, the settings of sensor (adapter) registered in the scan list will be read and backup sensor settings file will be created in the memory card of CPU unit.

● Create file with the "Transmission adapter settings" of EtherNet/IP Setting

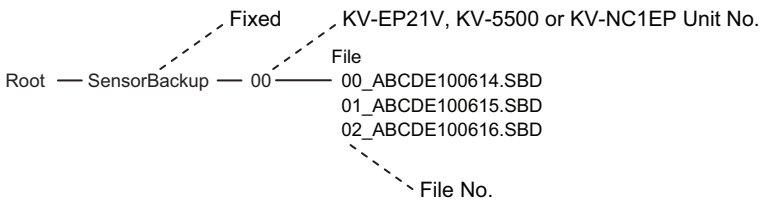
With "Transmission adapter settings" dialog box of EtherNet/IP Setting, backup sensor settings file can be created by setting up the parameters of the sensor (adapter) registered in the scan list. If the file is used to restore sensor settings, the backup sensor settings file should be stored in the memory card of CPU unit.
"Transmission Adapter Settings", page 5-56

Reference The settings can be directly transferred to each sensor (adapter) from "Transmission adapter settings" dialog box.

■ Storage format of backup sensor settings file

When executing the backup sensor settings, the backup sensor settings file will be stored in the memory card in the following way.
When executing the restore sensor settings, backup sensor settings file should be also stored in the following way.

Example



For the settings (such as file name) of the backup sensor settings file, see "Setup backup sensor settings", page 7-12.

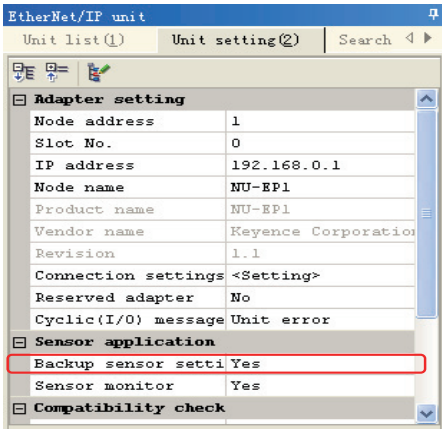
Setting Details of Backup Sensor Settings

The following describes the setting details about backup sensor settings.
For common settings with other functions of sensor application, see appropriate pages.

"Settings in Unit Editor Related to Sensor Application", page 7-4
"Scan List Settings", page 4-12
"Compatibility Check for Sensor Application", page 7-5

■ Object sensor setting

To set up object sensor of backup sensor settings function.
With the "Backup sensor settings" in "Unit setting" tab of EtherNet/IP Setting, set whether each sensor (adapter) is taken as target.
If backup sensor settings is not supported, the setting of the sensor will be greyout.



Select the adapter in the scan list of EtherNet/IP Setting, and set up in "Unit setting" tab.

""Unit Setting" Tab", page 5-22

Reference

It also can take the slot unit of rack configuration unit as object only.
Example) If EtherNet/IP communication adapter NU-EP1 from KEYENCE is used, each sensor (FS-N Series fiber sensor) connected can be set as object or not.

Point

In the following situations, even "backup sensor settings" is set to "Enable", the sensor (adapter) will not be taken as execution object, and error do not occur.

- **In case backup sensor settings is executed from VT3 Series, or "Reserve EtherNet/IP Device" is set for batch backup sensor settings from program.**
- **In case restore sensor settings is executed from VT3 Series, "Reserve EtherNet/IP Device" is set for batch restore sensor settings from program, or settings are not stored in the backup sensor settings file.**

■ Setup backup sensor settings

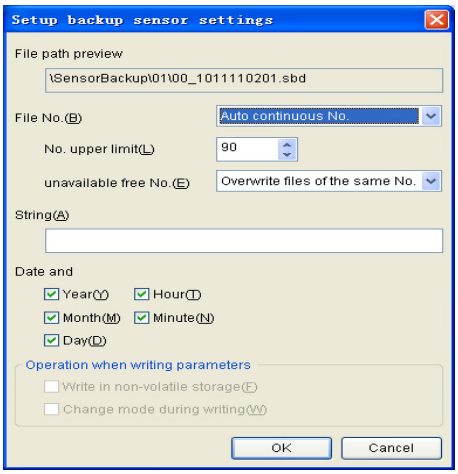
To set up backup sensor settings file name, etc.

1 **Click Setting -> setup backup sensor settings from the menu of EtherNet/IP Setting.**

Display “Setup backup sensor settings” dialog box.

Other procedure

In "KV STUDIO" workspace, select KV-EP21V and click “Sensor application” -> "Setup backup sensor settings" in the right-click menu.



Item			Description
File path preview*1			Display file saving location (file path) and an example of the file name.
File No.	File No.		Select from "Auto consecutive No./fix/specify No. at execution (use lower 2 digits)".
	Auto continuous No. *2		Use the minimum file No. of the No.s not used within the range of 0 to 99.
		No. upper limit	Set up the upper limit value of file No. (0 to 99).
		unavailable free No.	Select from "Overwrite the file with the same No."/"Abort backup sensor settings" *2.
	Fix		Specify a fixed value within the range of 0 to 99.
		No.	Set up the file No. (0 to 99).
		existing same files	Select from "Overwrite the file with the same No."/"Abort backup sensor settings".*2
	Specify at execution (use last 2)		In case of VT execution : specify with the "file No." in the backup sensor settings screen. In case of Ladder execution: specify with the "backup/restore execution file No." of DM.
		existing same files	Select from "Overwrite the file with the same No."/"Abort backup sensor settings.
String			Set up the character string to be added to the file name. *3 Setting range: <= 32 half-width characters
Date			If checked, the file name will include the creation date and time, at which the backup processing starts. Year (00 to 99), month (01 to 12), date (01 to 31), hour (00 to 23), minute (00 to 59)
Operation when writing parameters			In case of setting change, if the sensor (adapter) registered in the scan list requires to write to non-volatile storage, it will be displayed. If checked, execute write operation to the non-volatile storage when restoring sensor settings.
Change mode during writing			In case of setting change, if sensor (adapter) registered in the scan list requires to change the mode, it will be displayed. If checked, execute the mode change when restoring sensor settings.

***1 When executing backup, the following folders and files will be created in the root folder of the memory card of the CPU.**

SensorBackup/[Unit No.]/[File No.]_[Character string][Year][Month][Date][Hour][Minute].sbd

E.g.) (Root of memory card) /SensorBackup/01/32_KEYENCE1006140830.sbd

If the character string and date are not used, the underline will not be displayed behind the file No..

***2 If the upper No. limit is set and there is no free No., the next No. of the file with the latest time stamp will be used.**

E.g.) In case there is no free No. and the time stamp of No. 5 file is the latest, the file No. 6 will be used.

***3**

- **The following half-width characters can not be used, such as "*", "/", "<", ">", "?", "¥", "|", "%", ".", ":", ";" and """.**
- **The following full-width characters can not be used, such as "／", "：", "？", "￥", "×", "［", "］".**

For other full-width characters that can not be used, see "File/folder name restriction", page 11-13.

Execution of Backup Sensor Settings Function with VT3 Series

The following describes how to execute backup sensor settings function with VT3 Series touch panel display from KEYENCE.
For operation details of VT3 Series, see VT3 Series Hardware Manual and VT STUDIO Reference Manual.

Point

- **It can be used on the VT3 Series touch panel display from KEYENCE, with system program Version 4.0 or above and VGA screen resolution or higher.**
- **System mode screen can only be displayed as horizontal screen, and vertical screen is unavailable.**

■ Call method of special screen of VT3 Series

The following describes how to call special screens of VT3 Series (Backup sensor settings screen and restore sensor settings screen).

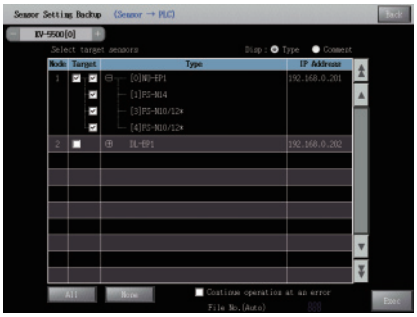
(1) Call from the "Monitor" screen in system mode



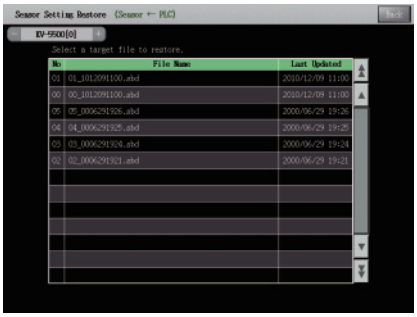
(2) Call with the "Call system screen" switch



Backup object sensor selection screen



Restore object sensor selection screen



Reference

When using the "Call system screen" switch to display the various screens of the backup sensor settings function, if the VT sensor application screen forced switching relay (CR2313) assigned to the CPU unit is ON, it will be switched to the call source screen.
"VT Sensor Application Screen Forced Switching Relay", page 7-6

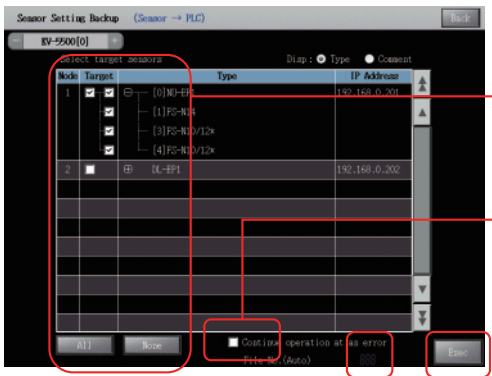
■ Steps of backup sensor settings function with VT3 Series

The following describes the steps of executing the backup sensor settings function with the backup sensor settings screen of VT3 Series.

The sensor (adapter) registered in the scan list of the selected unit will be displayed in the backup object sensor selection screen.

(Screens of VT3 Series)

<Backup object sensor selection screen>



(3)

Execute

Step (1) Select backup object sensor.

In case of individual setting, check the sensor individually.

It can be unfolded by (⊞) if there is slot unit.

Step (2) Set up the "operation continue at error".

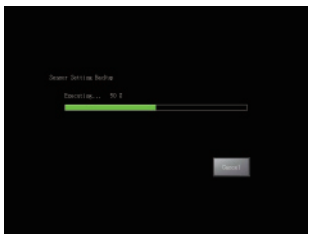
"Setting of operation at error", page 7-30

Step (3) (If the setting of file No. is "specify No. at execution (use lower 2 digits)", specify the backup sensor settings file No..

"Setup backup sensor settings", page 7-12

Step (4) Press "execute" button.

<Backup sensor settings execution in progress>



Read the setting of object sensor and store the backup sensor settings file in the memory card of the CPU unit.

For the "Cancel" button, see "Operation during execution of interrupt processing", page 7-27.

<Success>



<Failure>



Error details will be displayed in case of error.

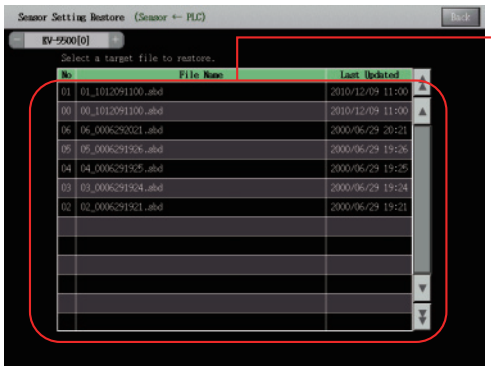
For the error details, see "List of the Complete Codes of the Sensor Application Functions", page 7-96.

■ Steps of restore sensor settings with VT3 Series

The following describes the steps of executing the restore sensor settings function with the restore sensor settings screen of VT3 Series. The backup sensor settings file stored in the memory card of the CPU unit, which is connected with the selected unit, will be displayed in the restore object file selection screen.

(Screens of VT3 Series)

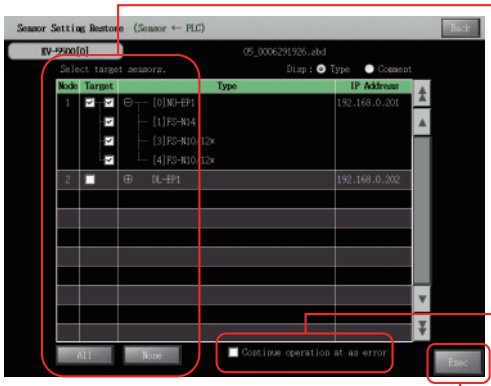
<Restore object file selection screen>



Step (1) Select the backup sensor settings file.

Select the backup sensor settings file in the memory card of the CPU unit that needs to be restored.

<Restore object sensor selection screen>



Step (2) Select the restore object sensor.

Select from the sensors (adapters) stored in the backup sensor settings file. In case of individual setting, check the sensor individually.
It can be unfolded by (⊞) if there is slot unit.

Step (3) Set up the "operation continue at error".
"Setting of operation at error", page 7-30

Execute

Step (4) Press "execute" button.

<Restore sensor settings execution in progress>



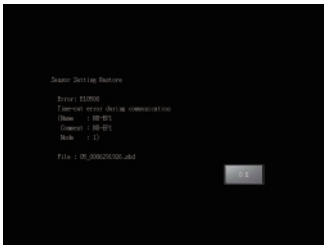
Read the backup sensor settings file in the memory card of the CPU unit, and transfer the settings to the object sensor.

For the "Cancel" button, see "Operation during execution of interrupt processing", page 7-27.

<Success>



<Failure>



Error details will be displayed in case of error.

For the error details, see "List of the Complete Codes of the Sensor Application Functions", page 7-96.

■ Display of object sensor

When the VT3 Series displays the backup object sensor selection screen or restore object sensor selection screen, the sensor (adapter) or parameter should be checked. In case of abnormal check, the following will be displayed in the front of the sensor.

Backup object sensor screen

: It is displayed if the object sensor is not connected or error occurs to compatibility check.

Restore object sensor selection screen

: It is displayed if the object sensor is not connected, or error occurs to compatibility check, or setting data is unavailable in the backup sensor settings file.

: It is displayed if parts of the parameters of the object sensor are not included in the backup sensor settings file.

Execute Backup Sensor Settings Function from Ladder Program

■ Device used in backup sensor settings function

● Relay

n: Leading relay No.

Relay No.	Name	Function	R/W
n+100	Execute Batch backup req	OFF->ON: For all object sensors (adapters) of the backup sensor settings, execute batch backup sensor settings. *1	W
n+101	Reserved for system	Unavailable	-
n+102	Execute Batch restore req	OFF->ON: For all object sensors (adapters) of the backup sensor settings, use the file specified by the "backup/restore execution file No." of DM to execute batch restore sensor settings.	W
n+103	Reserved for system	Reserved for system	W
n+104	Execute Specific backup req	OFF->ON: For the sensor specified by "individual backup execution node address" and "individual backup execution slot No." of DM, execute individual backup sensor settings. *1	W
n+105	Reserved for system	Unavailable	-
n+106	Execute Specific restore req	OFF->ON: For the sensor specified by "individual restore execution node address" and "individual restore execution slot No." of DM, use the file specified by "backup/restore execution file No." of DM to execute individual restore sensor settings.	W
n+107	Reserved for system	Unavailable	-
n+108	Backup/restore break req *2	OFF->ON: Interrupt all processing under execution. It will be ignored if the backup sensor settings function is not used. If the relay is in the process of ON and the request relay of the backup sensor settings function is ON, it will be interrupted immediately.	W
n+109	Backup/restore continue at error *2	In case various execution request relays OFF->ON, ON: When executing the requested processing, it will continue even if there is error. OFF: When executing the requested processing, it stops processing once there is error. "Setting of operation at error", page 7-30	W
n+110 to 115	Reserved for system	Unavailable	-
n+1100	Batch backup execute end	ON: It will be ON upon the completion of the requested processing. ON->OFF: It will be OFF when request relay is ON->OFF.	R
n+1101	Batch backup execute fail	ON: When there is error in processing the request, it will be ON at the time that is the same as complete relay. ON->OFF: It will be OFF when request relay is ON->OFF.	R
n+1102	Batch restore execute end	ON: It will be ON upon the completion of the requested processing. ON->OFF: It will be OFF when request relay is ON->OFF.	R
n+1103	Batch restore execute fail	ON: When there is error in processing the request, it will be ON at the time that is the same as complete relay. ON->OFF: It will be OFF when request relay is ON->OFF.	R
n+1104	Specific backup execute compd	ON: It will be ON upon the completion of the requested processing. ON->OFF: It will be OFF when request relay is ON->OFF.	R

Relay No.	Name	Function	R/W
n +1105	Individual backup execute fail	ON: When there is error in processing the request, it will be ON at the time that is the same as complete relay. ON->OFF: It will be OFF when request relay is ON->OFF.	R
n +1106	Specific restore execute compd	ON: It will be ON upon the completion of the requested processing. ON->OFF: It will be OFF when request relay is ON->OFF.	R
n +1107	Specific restore execute fail	ON: When there is error in processing the request, it will be ON at the time that is the same as complete relay. ON->OFF: It will be OFF when request relay is ON->OFF.	R
n +1108	Backup/restore is being*3	ON: Certain backup/restore processing of the backup sensor settings function is being executed.	R
n +1109 to 1115	Reserved for system	Unavailable	-

*1 In the setup backup sensor settings, if the "file No." is set to "specify No. at execution (use lower 2 digits), the file No. can be specified through the "backup/recover execution file No." of DM.

*2 It is invalid when executing from VT3 Series.

*3 It is valid when executing from VT3 Series.

- **DM**

Point

The setting or execution status of the backup sensor settings function specified by VT3 Series can not be updated to DM.

N: Leading DM No.

DM No.	Name	Function	R/W
N +100	Backup/recover execute file No.	Specify the file No. during execution of restore function, or during execution of backup where the "file No." is set to "specify No. at execution (use lower 2 digits)" in the setting of the backup sensor settings file.	W
N +101	Reserved for system	Unavailable	R
N +102	Batch backup comp code	Store complete code.	R
N +103	Batch backup detailCompCode	Store detailed complete code.	R
N +104	Batch backup error node address	When the request processing is completed with error, store the last error node address. When it succeeds, or the errors irrelevant to the node occur, store 0.	R
N +105	Batch backup error slot No.	When the request processing is completed with error, store the last error slot No.. When it succeeds, or the errors irrelevant to the sensor occur, store 0.	R
N +106	Batch backup err param No.L/H	When the request processing is completed with error, store the last error parameter No.. When it succeeds, or the errors irrelevant to the parameter occur, store 0.	R
N +107			

DM No.	Name	Function	R/W
N +108	Batch restore comp code	Store complete code.	R
N +109	Batch restore detailCompCode	Store detailed complete code.	R
N +110	Batch restore err node addr	When the request processing is completed with error, store the last error node address. When it succeeds, or the errors irrelevant to the sensor occur, store 0.	R
N +111	Batch restore error slot No.	When the request processing is completed with error, store the last error slot No.. When it succeeds, or the errors irrelevant to the sensor occur, store 0.	R
N +112	Batch restore err param No.L/H	When the request processing is completed with error, store the last error parameter No.. When it succeeds, or the errors irrelevant to the parameter occur, store 0.	R
N +113			
N +114	Specific backup exec node addr	Store the object node address that executes individual backup.	W
N +115	Specific backup execute slot No.	Store the object slot No. that executes individual backup. In case of there is no slot unit, store 0.	W
N +116	Individual backup comp code	Store complete code.	R
N +117	Specific backup detailCompCode	Store detailed complete code.	R
N +118	Specific backup err param No.L/H	When the request processing is completed with error, store the last error parameter No.. When it succeeds, or the errors irrelevant to the parameter occur, store 0.	R
N +119			
N +120	Specific restore exec node addr	Store the object node address that executes individual restore.	W
N +121	Specific restore exec slot No	Store the object slot No. that executes individual restore. In case of unit without slot, store 0.	W
N +122	Specific restore comp code	Store complete code.	R
N +123	Specific restore detailCompCode	Store detailed complete code.	R
N +124	Specific restore err param No.L/H	When the request processing is completed with error, store the last error parameter No.. When it succeeds, or the errors irrelevant to the sensor occur, store 0.	R
N +125			

For the complete codes and detailed complete codes of various functions, see "List of the Complete Codes of the Sensor Application Functions", page 7-96.

● Buffer memory

Point

The execution status of the backup sensor settings function executed from VT3 Series will also be updated to the buffer memory.

Buffer memory address	Name	Function	R/W
#2600	Backup/restore execute file No.	Store the file No. during backup/restore execution. After execution, the file No. will also be stored. In case of auto consecutive No. setting, during the period from processing start to acquiring the file No., or when the errors occur, store FFFF (H).	R
#2601	Backup/restore number of sensors	Store the number of backup/restore execution object sensors. The adapters reserved as EtherNet/IP Device are not included in the number of the sensors.	R
#2602	Bckuup/rstr num executed sensor	Store the number of the sensors that have completed backup/restore execution. The sensors that are skipped due to operation continues at error or those have errors on the parameter units are also included in the number of the complete sensors. The adapters reserved as EtherNet/IP Device are not included in the number of the sensors. By the combination with the "number of backup/restore object sensors", the progress of the execution of the backup/restore sensor settings can be checked.	R
#2603	Bckup/rstr max time node	Store the node address, slot No., and processing time (unit: 0.1s) of the sensor with the longest processing time for backup/restore execution. It also includes the sensors failed to backup due to error. In case of no rack configuration unit, the slot No. of the longest processing time will be stored as 0.	R
#2604	Bckup/rstr max time slot		R
#2605	Backup/restore max time		R
#2606	Backup/restore all execute time	Store the execution time of the backup/restore (unit: 0.1s). It also includes the sensors failed to backup due to error.	R
#2607	Backup/restore executing process	Store the processing under execution. 0: no execution processing 1: batch backup sensor settings (relay) 2: batch restore sensor settings (relay) 3: individual backup sensor settings (relay) 4: individual restore sensor settings (relay) 5: backup sensor settings (VT) 6: restore sensor settings (VT)	R
#2608	Backup/restore file name size	The name size (in byte) of the file stored during backup and the file after restore will be stored upon completion of various processing.	R
#2609	Backup/restore file name head	The file name stored during backup and the file name after restore will be stored with #2609 at the beginning when various processing are completed.	R
:	:		
#2736	Backup/restore file name tail		

Reference If the unit-specific command is used, the program can be prepared without the use of buffer memory address.

"Unit-specific Command for Backup Sensor Settings Function", page 7-33

- **CR**

Relay No.	Name	Function	R/W
CR2313	VT SensorAppli screen force chng	ON: set the display of VT3 Series as the call source screen. In case of other screen, if the relay is set to ON, it will forcibly switch to the call source screen.	W

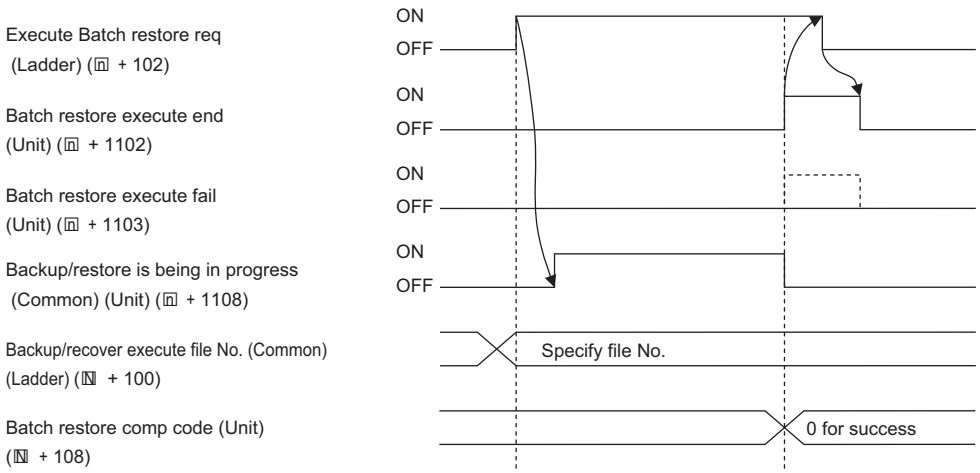
■ Steps and reference program of batch backup/restore sensor settings

The following describes the steps and reference program of batch backup/restore sensor settings with the Ladder program.

Here describes the batch restore sensor settings. When executing the batch backup sensor settings, please change the name of the devices other than common devices.

"Device used in backup sensor settings function", page 7-18

● Steps



(1) Store the file No. used for the batch restore in the backup/restore execution file No. *1 and set the batch restore execution request relay to ON.

(2) Upon the start of batch backup sensor settings, the backup/restore execution in progress relay ON.

(3) Upon the completion of batch restore sensor settings, the batch restore execution complete relay ON.

If the batch restore execution fail relay is ON, the batch restore complete code will be read and the error processing will be executed.

(4) Check the batch restore execution complete relay is ON and set the batch restore execution request relay to OFF. *2

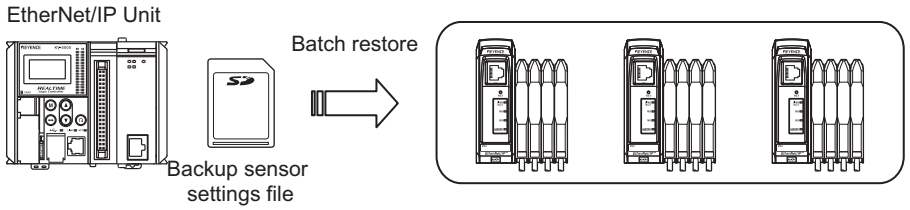
(5) If KV-EP21V detects the batch restore execution request relay is OFF, the batch restore execution complete relay will be OFF.

***1 For batch backup, when selecting the "file No." as "specify No. at execution (use lower 2 digits)" in the setting of backup sensor settings file, it is necessary to set.**

***2 If "operation continue at error" is set and the error occurs during execution of batch backup/restore sensor settings, it will not stop and the processing of remained sensors and parameters will continue.**

● Reference program of batch restore sensor settings

The following describes the sample program for executing batch restore settings of the sensor (EtherNet/IP adapter) registered in the scan list.



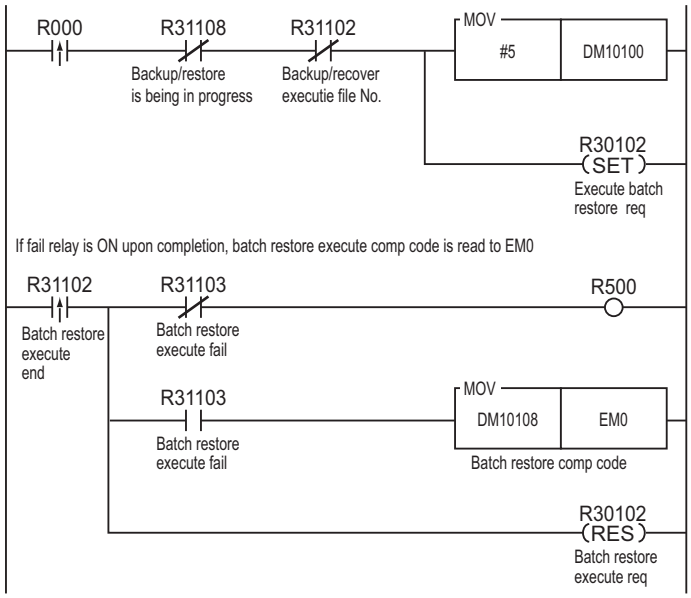
Point

KV-NC32T is necessary when using backup sensor settings on the KV-NC1EP.

Setting in Unit Editor

Setting items	Description
Leading DM No.	DM10000
Leading relay No.	R30000

E.g.) Specify No. 5 backup sensor settings file and execute batch restore sensor settings.



(Mnemonic list)

```
LDP R000
ANB R31108
ANB R31102
MOV #5 DM10100
SET R30102
LDP R31102
MPS
ANB R31103
OUT R500
MRD
AND R31103
MOV DM10108 EM0
MPP
RES R30102
```

7 SENSOR APPLICATION

■ Steps and reference program of individual backup/restore sensor settings

The following describes the steps and reference program of the individual backup/restore sensor settings with the Ladder program.

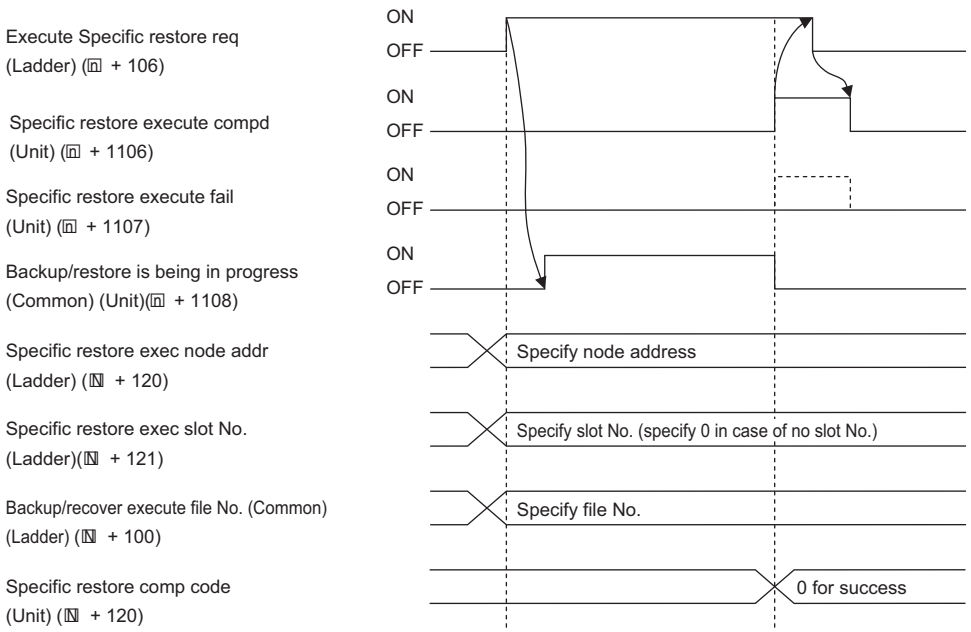
For individual backup/restore sensor settings, specify the node address and slot No. of the object sensor and execute backup/restore settings.

● Steps

Here describes the steps of individual restore sensor settings.

When executing individual backup sensor settings, please change the name of devices other than common devices.

"Device used in backup sensor settings function", page 7-18



(1) Store specific restore exec node addr, specific restore exec slot No. *1 and backup/restore execute file No. *2, and set the specific restore execution request relay to ON.

(2) Upon the start of specific restore sensor settings, the backup/restore execution in progress relay changes to ON.

(3) Upon the completion of specific restore sensor settings, the specific restore execution complete relay changes to ON.
If the specific restore execution fail relay is ON, the specific restore complete code will be read and the error processing will be executed.

(4) Check the specific restore execution complete relay is ON and set the specific restore execution request relay to OFF.

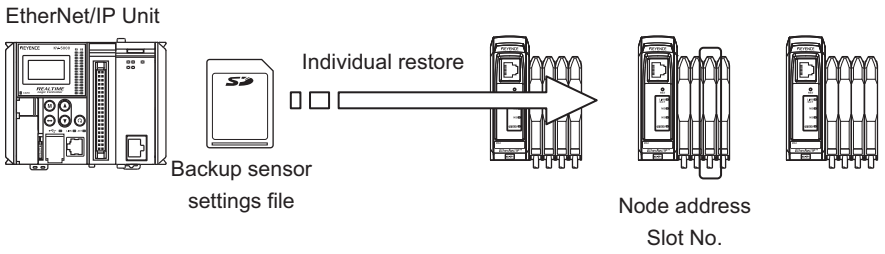
(5) If the EtherNet/IP Unit detects that the specific restore execute req relay is OFF, the specific restore execute complete relay will change to OFF.

*1 For the unit other than slot configuration unit, the slot No. must be stored as 0.

*2 For individual backup, if the "file No." in the setting of the backup sensor file setting is selected as "specify No. at execution (use lower 2 digits), it is necessary to set.

● Reference program

The following describes the sample program for executing individual restore settings of the sensor (EtherNet/IP adapter) registered in the scan list.



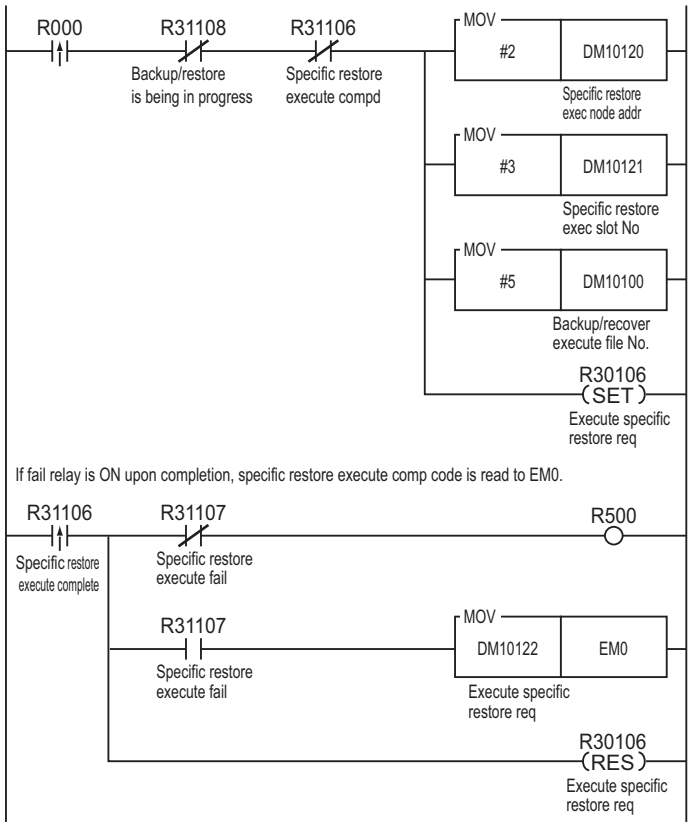
Point

KV-NC32T is necessary when using backup sensor settings on the KV-NC1EP.

Setting in Unit Editor

Setting items	Description
Leading DM No.	DM10000
Leading relay No.	R30000

Example) For sensor with node address 2 and slot No. 3, specify No. 5 backup sensor settings file and execute individual restore sensor settings.



(Mnemonic list)

```
LDP R000
ANB R31108
ANB R31106
MOV #2 DM10120
MOV #3 DM10121
MOV #5 DM10100
SET R30106
LDP R31106
MPS
ANB R31107
OUT R500
MRD
AND R31107
MOV DM10122 EM0
MPP
RES R30106
```

■ Steps and reference program of interrupt processing of backup/restore sensor settings

Here describes the steps and reference program of the interrupt processing of the backup/restore sensor settings with the Ladder program.

When pressing the "Cancel" button in the "execution in progress screen" of the backup sensor settings of the VT3 Series, the operation will be the same.

● Operation during execution of interrupt processing

Interrupt processing is executed by parameter.

Therefore, the interrupt may occur in the state of the parameter completion backup/restore of the mid-way of one sensor.

If the interrupt processing is executed during execution of restore, restore must be executed again.

The operation after interrupt processing is show below.

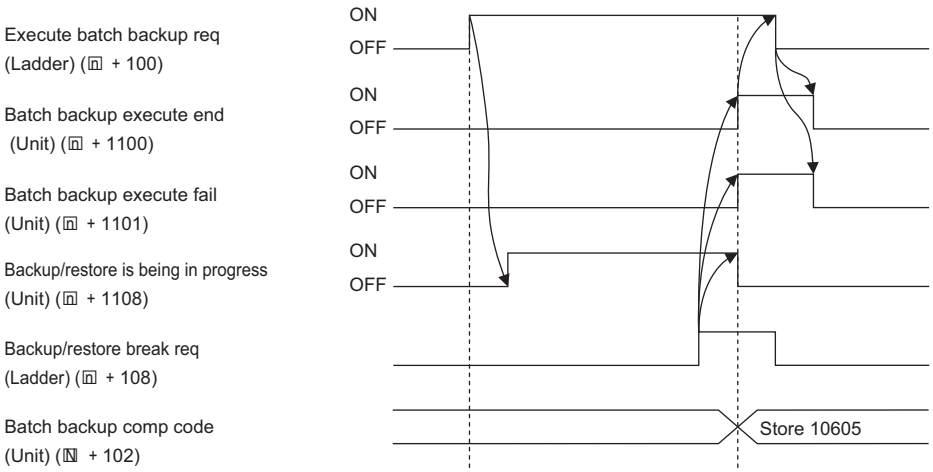
Item		Description
Relay	Execution complete relay	ON
	Execution fail relay	
DM	Complete code	10605 (Interrupt error based on interrupt request)
	Detailed complete code	0 (Fixed value)
	Error node address	
	Error slot No.	
	Error parameter No.	
Buffer memory	Longest processing time node address	Store the sensor results including those processed with the interrupt request.
	Longest processing time slot No.	
	Longest processing time parameter No.	
	Total execution time	
	Number of execution complete sensors	The number of sensors processed is stored. Sensors processed in the interrupt request are excluded.
Backup sensor settings file		During creation, the backup sensor settings file is deleted and not stored.
VT3 Series		Display execution fail screen.

Point

In the case of having executed the interrupt request, even if the operation continue at backup/restore error relay is ON, it will be immediately interrupted.

● Procedures for interrupt processing of backup/restore sensor settings

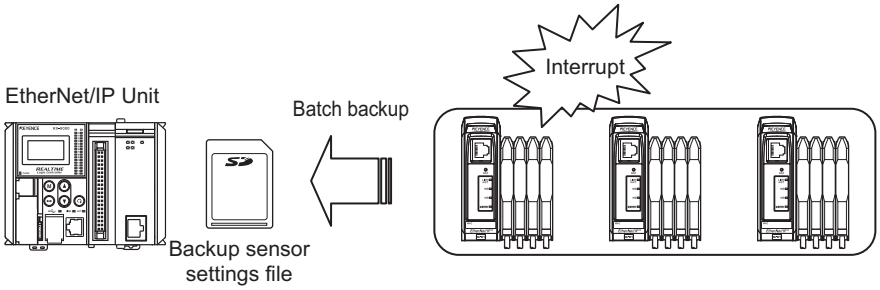
The following describes the interrupt procedures during execution of batch backup sensor settings. When it is interrupted in the process of executing other functions, please change the name of devices before use.



(1) Set the Execute Batch backup req relay to ON.
(2) Upon start of the batch backup sensor settings, the backup/restore execution in progress relay changes to ON.
(3) Set the backup/restore interrupt processing request relay to ON.
(4) Upon accepting the interrupt processing of backup sensor settings, the batch backup execute end relay and the batch backup execute fail relay change to ON, while the backup/restore execution in progress relay changes to OFF.
(5) Check the batch backup execute end relay ON, and set the batch backup execute req relay and the batch backup break req relay to OFF.
(6) If the EtherNet/IP Unit detects that the batch backup execute req relay is OFF, the batch backup execute end relay will change to OFF.

● Reference program

The following describes the sample program which happens when batch backup settings of the sensor (EtherNet/IP adapter) registered in the scan list is interrupted.



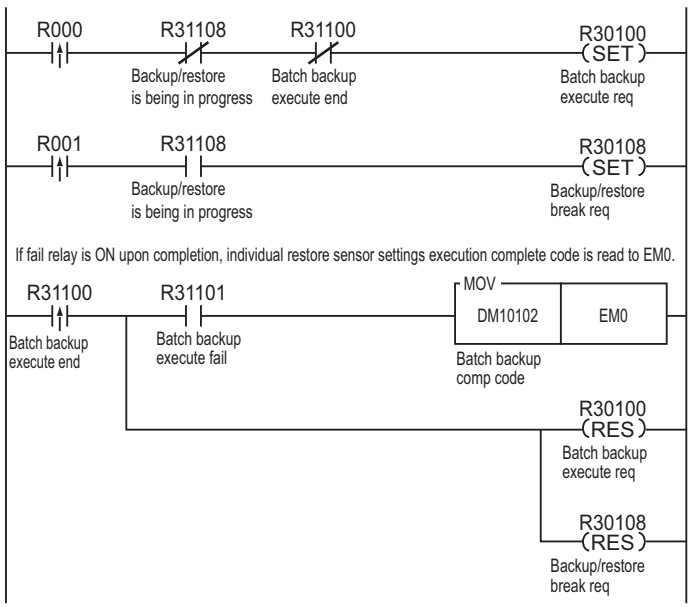
Point

KV-NC32T is necessary when using backup sensor settings on the KV-NC1EP.

Setting in Unit Editor

Setting items	Description
Leading DM No.	DM10000
Leading relay No.	R30000

e.g.) Interrupt happens in the process of batch backup sensor settings.



(Mnemonic list)

```
LDP R000
ANB R31108
ANB R31100
SET R30100
LDP R001
AND R31108
SET R30108
LDP R31100
MPS
AND R31101
MOV DM10102 EM0
MRD
RES R30100
MPP
RES R30108
```

Attentions on using the Backup Sensor Settings Function

■ Simultaneous execution of the backup sensor settings function

One backup sensor settings can be executed simultaneously.

e.g.) When using VT3 Series to execute the backup sensor settings function, the function cannot be executed by using the execution request relay from the program.

If other execution request is executed in the process of executing the backup sensor settings function, the operation is as follows.

Execution mode	Result
VT3 Series	Execution fails and the execution fail screen appears.
Execution request relay (program)	The execution request error during processing will be stored in the complete code, and the complete relay and the fail relay will be ON.

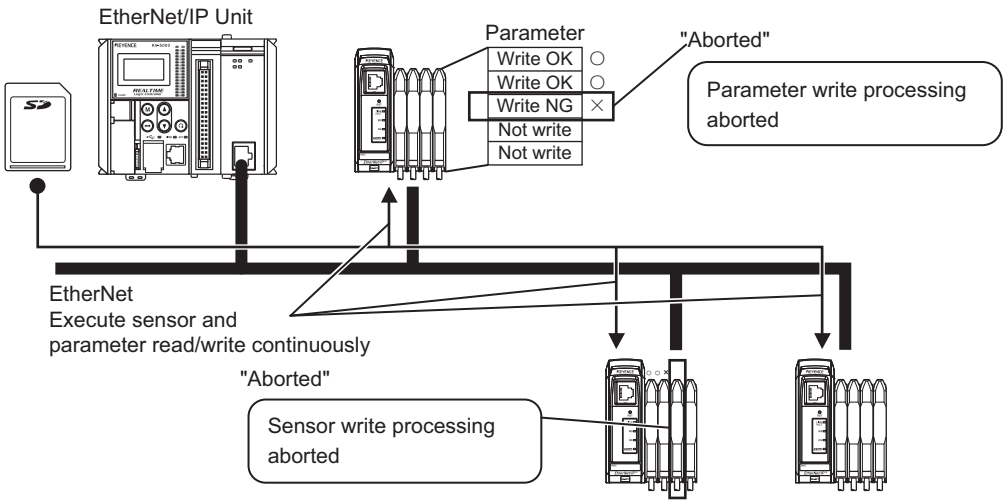
■ Simultaneous execution of backup sensor settings function for different sensors (node addresses)

In the event of executing the backup sensor settings function, parameter read/write is available for up to 16 sensors (adapters) at the same time. It will be processed in accordance with the order of node address, slot No., and parameter No. assigned to the sensors (adapters).

■ Setting of operation at error

When executing the backup sensor settings function, the setting read/write can be executed continuously for multiple parameters of multiple sensors (adapters). Therefore, even if there is communication error with part of the sensors (adapters), or read/write error of specific parameters, it will be detected as an error in the process of executing the backup sensor settings. In the event of read/write errors of the parameters in the process of execution, it can be set to stop the backup sensor settings function or set to continue read/write for other sensors (adapter unit) or for other parameters. Setting method depends on using VT3 Series or using program.

Errors occur in the process of executing backup sensor settings function



● Setting method for the operation continue at error from VT3 Series

When executing from VT3 Series, at the start of the backup sensor settings function, set up in the backup object sensor selection screen or the restore object file selection screen of VT3 Series.

Not continue : in case of error, the execution will be stopped and the causes will be displayed in the fail screen.

Continue : continue processing of other sensors or parameters. After all processing are completed, the causes of error will be displayed in the complete screen.

"Execution of Backup Sensor Settings Function with VT3 Series", page 7-14

● Setting method for the operation continue at error from program

When executing from the program, set the operation continue at backup/restore error relay to ON. When the operation continue at backup/restore error relay is ON, if the execution request relay is set to ON, the operation will continue in case of error during execution. After the execution request relay is set to ON, even if the operation continue at backup sensor settings error relay is set to ON, operation will not continue in the event of error.

Not continue (operation continue at error relay is OFF)

: Stop the backup/restore processing in case of error. When the execution fail relay is ON, the cause of error will be stored in the assigned DM*.

Continue (operation continue at error relay is ON)

: Continue to process backup/restore of other sensors or parameters in case of error. After all processing has been completed and the execution fail relay is ON, the cause of the last error occurred will be stored in the assigned DM*.

* Store the complete code, the detailed complete code, the error parameter No., the error node address No. and the error slot No..

Point

In the event of the operation not continue at error, the processing of other sensors (adapters) in the parallel will also stop; therefore, the processing of parameter read/ write of the sensor (adapter) will also stop at halfway.

● Operation in case of operation continue at error

The continued processing of the operation continue at error is as follows.

Cause of error	Operation
Error (function)	For backup sensor settings function error, operation cannot to be continued Execution is stopped immediately.
Error (node)	Error occurs on communication with node (adapter, communication adapter in case of rack configuration unit). Continue processing for the next node. In case the slot unit exists, the rest parameters of the sensor processed when error occurs and the parameters of the rest sensors (slot unit) are not processed.
Error (sensor)	Communication error with sensors (the slot unit of rack configuration unit). Continue processing for the next sensor (slot unit). The rest parameters of the error sensor (slot unit) shall be left unprocessed.
Error (parameter)	The error occurs in processing specific parameter. Continue processing for the next parameter No..

* For the causes of error occurred, see"List of the Complete Codes of the Sensor Application Functions", page 7-96

● Backup sensor settings file at error

In the process of executing the batch/individual backup sensor settings, the content of the backup sensor settings file at error is as follows.

Cause of error *	Content of backup file
Error (function)	For backup sensor settings function error, operation cannot to be continued Execution is stopped immediately. The backup file is not created.
Error (node)	Error occurs on communication with node (adapter, communication adapter in case of rack configuration unit). The setting of the node read normally will be stored in the backup file. If there is no successful communication node, do not create the backup file.
Error (sensor)	Communication error with sensors (the slot unit of rack configuration unit). The setting of the sensor read normally will be stored in the backup file. Only store the setting of successful sensor.
Error (parameter)	The error occurs in processing specific parameter. The setting of the parameter will not be stored in the backup file. Only store the setting of the parameter read successfully.

* For the causes of error occurred, see"List of the Complete Codes of the Sensor Application Functions", page 7-96

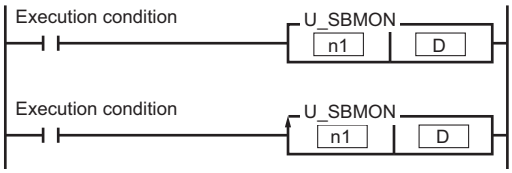
Unit-specific Command for Backup Sensor Settings Function

■ List of unit-specific commands for backup sensor settings function

Function	Command	Operation	Page
Acquire backup sensor settings execution status	U_SBMON	Read the execution status of the backup sensor settings function.	7-34
Read backup sensor settings file name	U_SBNAME	Read the file name of the backup sensor settings file from the buffer memory.	7-36

U_SBMON	**U_SBMON(.U)**	U_SBMON	Acquire backup sensor settings execution status	Read the execution status of the backup sensor settings function from the buffer memory.
@U_SBMON	**@U_SBMON(.U)**	U_SBMON		

Ladder program



Input method

U_SBMON n1 D

@U_SBMON n1 D

Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
D	○	-	○	-	-	-	○	○	○*3	○	○	-	-	-	○	-	-	○	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
D	Specify the leading device to store execution status. *1*2

*1 If the bit device is specified, consecutive 128 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 128 bits will be processed by crossing over to the next channel.

*2 If word device is specified, consecutive 8 words will be processed.

*3 EM, FM and ZF cannot be used with the KV Nano Series.

Point

KV-NC32T is necessary when using backup sensor settings on the KV-NC1EP.

Operation Description

U_SBMON If execution condition is ON, read the execution status of backup sensor settings function of No. n1 unit, and store it in 8 words with D as leading device.

Execution status	Buffer memory address	Device No.
Backup/recover execution in progress file No.	#2600	D + 0
Number of backup/restore object sensors	#2601	D + 1
Number of backup/restore execution complete sensors	#2602	D + 2
Longest backup/restore time node address	#2603	D + 3
Longest backup/store time slot No.	#2604	D + 4
Longest backup/restore time	#2605	D + 5
Total backup/restore time	#2606	D + 6
Processing of backup/restore execution in progress	#2607	D + 7

@U_SBMON At the rising edge of the execution condition, the scan will be executed only once.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON if any of the following conditions is met, otherwise it is OFF. • The unit No. specified by n1 is out of range. • The unit with the unit No. specified with n1 is not KV-EP21V, KV-5500 or KV-NC1EP. • From the device specified by D, 8-word device cannot be guaranteed. • The range of indirect specifying and index modification are inappropriate.

* If CR2012 is ON, command is not executed.

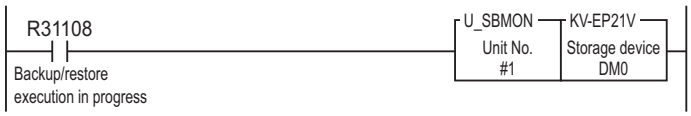
KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

Sample Program

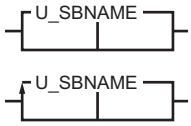
In the process of executing backup sensor settings, store the execution status in DM0 to DM7.



(Mnemonic list)

```
LD R31108
U_SBMON #1 DM0
```

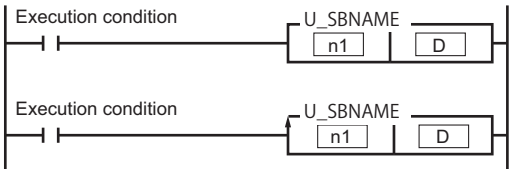
U_SBNAME U_SBNAME(.U) @U_SBNAME @U_SBNAME(.U)



Read backup sensor settings file name

Read the file name of the backup sensor settings file from the buffer memory.

Ladder program



Input method

U_SBNAME n1 D ↵

@U_SBNAME n1 D ↵

Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
D	○	-	○	-	-	-	○	○	○*3	○	○	-	-	-	○	-	-	○	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
D	Specify the leading device to store file name. *1*2

*1 If the bit device is specified, consecutive 2064 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 2064 bits will be processed by crossing over to the next channel.

*2 If word device is specified, consecutive 129 words will be processed.

*3 EM, FM and ZF cannot be used with the KV Nano Series.

Point

KV-NC32T is necessary when using backup sensor settings on the KV-NC1EP.

Operation Description

U_SBNAME If execution condition is ON, read the backup sensor settings file name of No. n1 unit from the buffer memory, and store the file name size (in byte) in D +0, and store the file name in devices starting from D +1 in accordance with the number of character strings specified by the file name size.

Backup file name	Buffer memory address	Device No.
Backup sensor settings file name size	#2608	D + 0
Backup sensor settings file name 0	#2609	D + 1
to backup sensor settings file name 127	to #2736	to D + 128

@U_SBNAME At the rising edge of the execution condition, the scan will be executed only once.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON if any of the following conditions is met, otherwise it is OFF. • The unit No. specified by n1 is out of range. • The unit with the unit No. specified with n1 is not KV-EP21V, KV-5500 or KV-NC1EP. • From the device specified by D, 129-word device cannot be guaranteed. • The value of the backup sensor settings file name size (#2608) is larger than 256. • The range of indirect specifying and index modification are inappropriate.

* If CR2012 is ON, command is not executed.

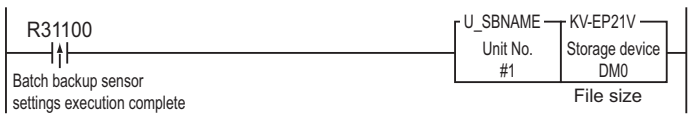
KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

Sample Program

When the backup sensor settings execution has completed, read the backup sensor settings file name size to DM0 and read the file name to devices starting from DM1.



(Mnemonic list)

```
LDP R31100
U_SBNAME #1 DM0
```

Unit-specific Function for Backup Sensor Settings Function

■ List for unit-specific function of backup sensor settings function

Function	Function	Operation	Page
Acquire backup sensor settings execution status	U_SBMON	Read the execution status of the backup sensor settings function.	7-39
Acquire backup sensor settings file name	U_SBNAME	Read the file name of the backup sensor settings file from the buffer memory.	7-40

U_SBMON Acquire backup sensor settings execution status

U_SBMON ([execution condition][*1], unit No., storage device No.)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No.[*2]	Specify unit No. (0 to 63, "0" when specifying KV-5500 as the main unit, KV-NC1EP).	-	-	-	-	-	-	-	-	○	-	-
S	Storage device No.[*3*4*5]	Specify the leading device No. to store execution status.	.U	.U	.U	.U	-	-	-	-	-	○	-

*1 [ ] can be omitted. (If execution condition is omitted, the function is execute in each scanning)

*2 $ (specify hex) can not be used.

*3 It cannot be specified for CTC, CTH and Z.

*4 If bit device is specified for D, consecutive 128 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

*5 If word device is specified for D, consecutive 8 words will be processed.

Point

KV-NC32T is necessary when using backup sensor settings on the KV-NC1EP.

Operation Description

U_SBMON If execution condition is ON, read the execution status of backup sensor settings function from No. n unit, and store it in 8 words with D as leading device.

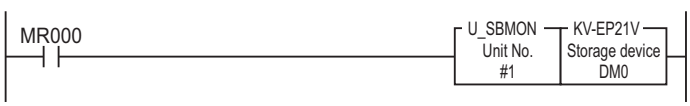
Execution status	Buffer memory address	Device No.
Backup/recover execution in progress file No.	#2600	D + 0
Number of backup/restore object sensors	#2601	D + 1
Number of backup/restore execution complete sensors	#2602	D + 2
Longest backup/restore time node address	#2603	D + 3
Longest backup/store time slot No.	#2604	D + 4
Longest backup/restore time	#2605	D + 5
Total backup/restore time	#2606	D + 6
Processing of backup/restore execution in progress	#2607	D + 7

- **Format example**

Script U_SBMON(MR0,1,DM0)

Operation When MR000 is ON, store the execution status in DM0 to DM7.

Ladder



7 SENSOR APPLICATION

U_SBNAME Acquire backup sensor settings file name

U_SBNAME ([execution condition][*1], unit No., storage device No.)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No.[*2]	Specify unit No. (0 to 63, "0" when specifying KV-5500 as the main unit, KV-NC1EP).	-	-	-	-	-	-	-	-	○	-	-
S	Storage device No.[*3*4*5]	Specify the leading device No. to store file name.	.U	.U	.U	.U	-	-	-	-	-	○	-

*1 [ ] can be omitted. (If execution condition is omitted, the function is execute in each scanning)

*2 $ (specify hex) can not be used.

*3 It cannot be specified for CTC, CTH and Z.

*4 If the bit device is specified for D, consecutive 2064 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 2064 bits will be processed by crossing over to the next channel.

*5 If word device is specified for D, consecutive 129 words will be processed.

Point

KV-NC32T is necessary when using backup sensor settings on the KV-NC1EP.

Operation Description

U_SBNAME If execution condition is ON, read the backup sensor settings file name from No. n unit, and store the file name size (in byte) in D, and store the file name in devices starting from D+1 in accordance with the number of character strings specified by the file name size.

Backup file name	Buffer memory address	Device No.
Backup sensor settings file name size	#2608	D + 0
Backup sensor settings file name 0	#2609	D + 1
to backup sensor settings file name 127	to #2736	to D + 128

● Format example

Script

U_SBNAME(MR0,1,DM0)

Operation

If MR000 is ON, store the file name size of backup sensor settings file in DM0 and store the file name in devices starting from DM1.

Ladder



7-5 Sensor Monitor

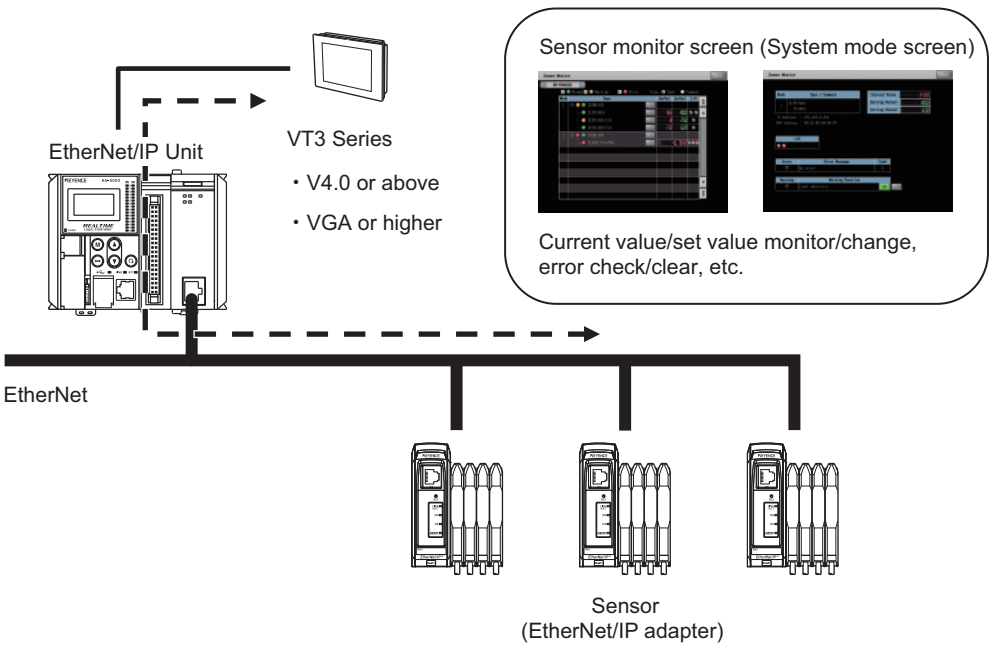
This section gives a general description on sensor monitor function.

Overview

Sensor monitor function enables to monitor the status of the sensor (EtherNet/IP communication unit NU-EP1 from KEYENCE, or FS-N10 Series fiber sensor connected), which is registered in the scan list, in the monitor screen (system mode screen) of VT3 Series touch panel display (from KEYENCE) connected with the CPU unit, while special setting or drawing is not required.

Point

- **It can be used on the VT3 Series touch panel display from KEYENCE, with system program Version 4.0 or above and VGA screen resolution or higher.**
- **System mode screen can only be displayed as horizontal screen, and vertical screen is unavailable.**



Point

- **Sensor monitor function is available for the sensor executing cyclic (I/O) messages with EtherNet/IP Units.**
- **The sensor (adapter) supporting sensor monitor function can be respectively set to object by selecting "set/not set" in "sensor monitor" under "unit setting" tab of EtherNet/IP Setting.**
  For the sensor not supporting sensor monitor function, the setting is greyout and not available.

● Overview of sensor monitor screen of VT3 Series

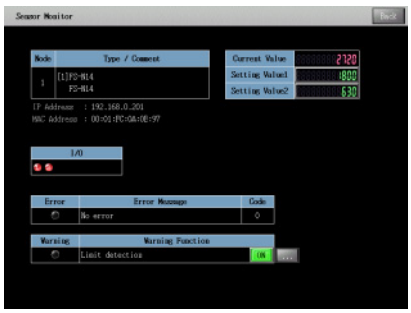
The following describes each screen used by sensor monitor function.
The content on the screen has been set in advance in accordance with sensors, so no additional setting is required.

(1) Sensor monitor general screen



Display the list of sensors (adapters) registered in the scan list and execute
• error/warning status display *
• current value/set value/output display.

(2) Sensor monitor detailed screen



It is used to check the detailed information of each sensor..
It can be opened by pressing the button corresponding to different formats of the general screen.
Execute
• current value/set value/output display
• set value change
• error/warning content display*
• clear error
• enable/disable warning
for each sensor.

(3) Setting screen of sensor monitor function



If the setting of warning function is available for the object sensor, it can be opened with the corresponding button from the detailed screen.
Set appropriate content for each function.

* The error and warning of each sensor (adapter) displayed in sensor monitor can be checked with the adapter error (overall) relay, adapter warning (overall) relay, adapter error table of DM and adapter warning table of the devices assigned to the EtherNet/IP Unit.
"Devices used in cyclic (I/O) messages", page 4-63

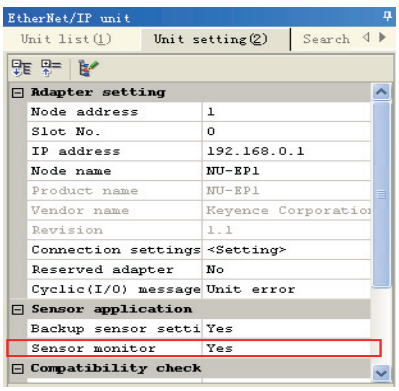
Settings of Sensor Monitor Function

The following describes the settings related to sensor monitor function.
For common settings with other functions of sensor application, see appropriate pages.

"Settings in Unit Editor Related to Sensor Application", page 7-4
"Scan List Settings", page 4-12
"Compatibility Check for Sensor Application", page 7-5

■ Object sensor setting

To set up the sensor which serves as the object of sensor monitor function.
The sensor (adapter) can be respectively set to object of the sensor monitor function by selecting "set/not set" in "sensor monitor" under "unit setting" tab of EtherNet/IP Setting.
For the sensor not supporting sensor monitor function, the setting is greyout and not available.



Select the sensor in the scan list of EtherNet/IP Setting and set up in "unit setting" tab.

""Unit Setting" Tab", page 5-22

Reference

The sensor can be set to object or not by the slot unit of rack configuration unit.
Example) If EtherNet/IP communication adapter NU-EP1 from KEYENCE is used, each sensor (FS-N10 Series fiber sensor) connected can be set as object or not.

Point

Even if "sensor monitor" is selected as "enable", the sensor to which "reserve EtherNet/IP Device" is set or the sensor stopping cyclic (I/O) messages with EtherNet/IP Units cannot be used as objects.

Settings of Sensor Monitor Function

The following describes how to use sensor monitor function in VT3 Series touch panel display.
For the details on operation of VT3 Series and the restrictions on using sensor monitor function, see
"VT3 Series Hard Manual" and "VT STUDIO Reference Manual".

Point

- **It can be used in VT3 Series with program version 4.0 or above, and resolution above VGA.**
- **System mode screen can only be displayed as horizontal screen, and vertical screen is unavailable.**

■ Call method of sensor monitor screen of VT3 Series

The following describes how to call the sensor monitor screen (general screen) of VT3 Series.

(1) Call from the "Monitor" screen in system mode



(2) Call with the "Call system screen" switch



Sensor monitor general screen



Reference

When using the "Call system screen" switch to display various screens of sensor monitor function, if the VT sensor application screen forced switching relay (CR2313) assigned to the CPU unit is ON, it will be switched to the call source screen..
"VT Sensor Application Screen Forced Switching Relay", page 7-6

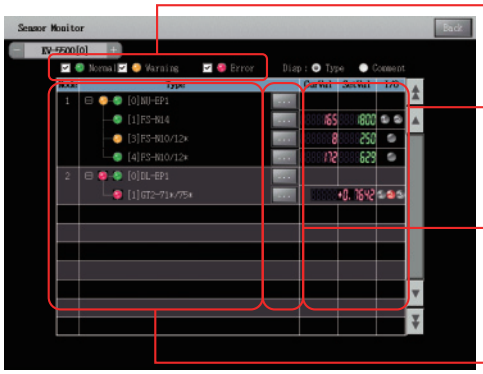
Contents of the Sensor Monitor Screen of VT3 Series

The following describes the display contents of sensor monitor screen of VT3 Series. Depending on the selected sensor (adapter), the detailed screen and the setting screen of sensor monitor display different contents.

For the screen contents or restrictions of each sensor, see appropriate sensor manuals.

■ Display contents of sensor monitor general screen

This screen displays the list of object sensors (adapters) of sensor monitor function.



Display the sensors compactly by normal/ warning/error.

Display the current value/set value/output of the object sensor.

Open the sensor monitor detailed screen of the object sensor. No button will be displayed if there is no detailed screen.

Display the list of object sensors of the sensor monitor function.

It can be unfolded by (⊞) if there is slot unit.

● Display of object sensor status

The status of object sensor will be displayed in front of its model.

(Communication error) : Normal communication is unavailable between object sensor (adapter) and EtherNet/IP Units.

In case of normal communication with object sensor, it indicates its operation status.

(Green: normal) : object sensor (adapters) works normally.

(Red: sensor error) : error occurs on object sensor (adapter) .
In case of both sensor error and sensor warning occur, only sensor error will be displayed.

(Yellow: sensor warning): warning occurs object sensor (adapter).

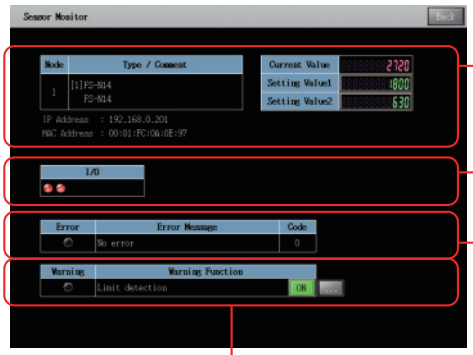
For rack configuration unit, the overall status of adapters is displayed in the front of the communication adapter. The status will still be displayed even there is a communication error, sensor error or sensor warning occurs on any slot unit (sensor). In case the above error and warning occur at the same time, they will be displayed in the order of communication error, sensor error and sensor warning.



Reference The error and warning of all adapters can be checked with the adapter error (overall) relay and adapter (warning) relay which are assigned to the device.
"Devices used in cyclic (I/O) messages", page 4-63

■ Sensor monitor detailed screen

The sensor monitor detailed screen will be displayed when pressing the button corresponding to different sensor types on the sensor monitor screen. Depending on the selected sensor (adapter), the sensor monitor detailed screen display different contents.
For the screen contents of each sensor, see appropriate sensor manuals.
(Screen example)



Display the information/current value/set value of each sensor. Some of the set values can be changed.

Display the I/O status of each sensor.

Display the details of the error that is ongoing. Some of the errors can be cleared.

Display the details of the warning that is ongoing. Press the button* configured at the right of warning function display to open the setting screen of sensor monitor function.
* It will be displayed if the detailed setting of warning function is available.

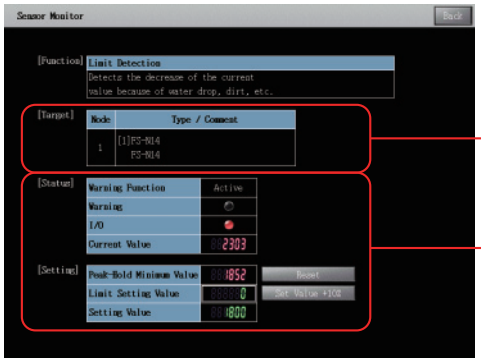
Point **The contents of detailed sensor monitor screen will vary with object sensors.**

■ Setting screen of sensor monitor function

The detailed settings of the warning function of sensors will be displayed when the button on the sensor monitor detailed screen is pressed.

For the screen contents or detailed warning function of each sensor, see appropriate sensor manuals.

(Screen example)



Display the details of the warning that is ongoing.

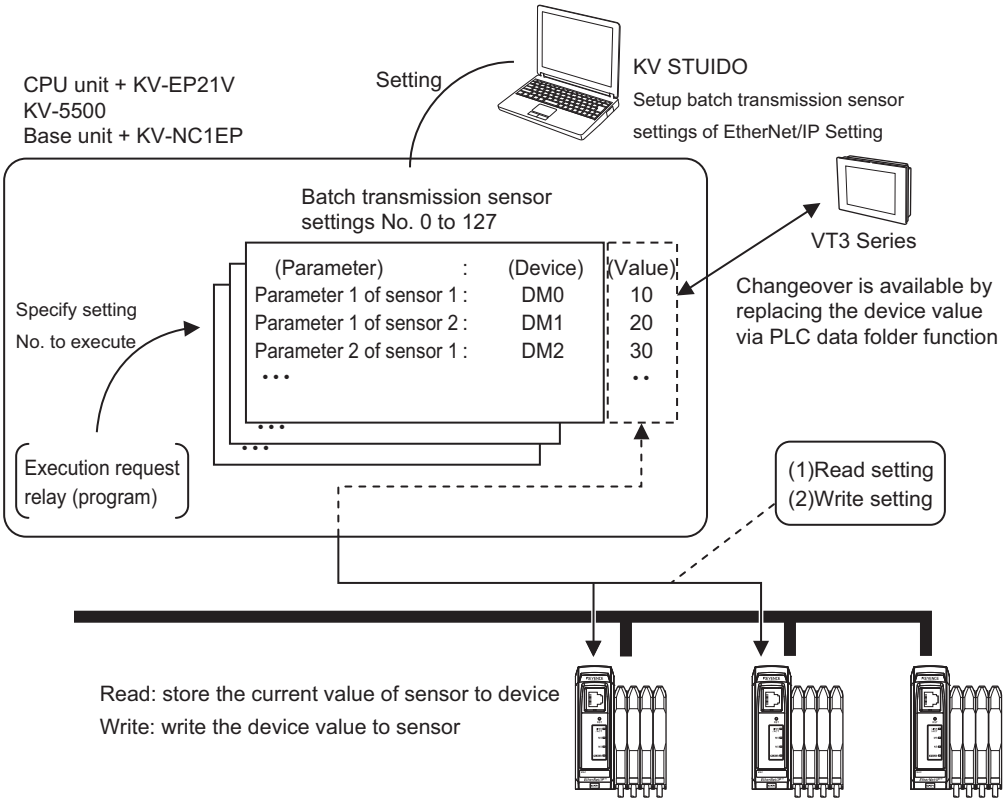
Set up the detailed warning function.

7-6 Batch Transmission Sensor Settings

This section describes the batch transmission sensor settings function and how to use it.
The batch transmission sensor settings function include read and write batch transmission sensor settings.

Overview

With batch transmission sensor settings function, the settings of the connected sensors (adapters) can be read and written through simple settings and operations.
For multiple sensors (adapters) registered in the scan list, with setup batch transmission sensor settings assigned to the devices, control is available to read/write the settings of sensors and the device values.
Setup batch transmission sensor settings enables to register multiple sensor settings. Thus, the setting change of the whole unit, such as changeover, can be done at once.



Point

- **When the batch transmission sensor settings function is used, Get_Attribute_Single service is executed when the sensor (adapter) is read, and Set_Attribute_Single service is executed when the sensor (adapter) is written. (In case of units from KEYENCE, some different services are used)**
- **The sensors (adapters) and parameters supporting batch transmission sensor settings function are the ones displayed in the "setup batch transmission sensor settings" dialog box of EtherNet/IP setting.**

Reference If the information exported from the import support information of setup batch transmission sensor settings is imported through VT STUDIO and KV COM+ for EXCEL, the setting names of the sensors can be used as comments during PLC data folder edition.

"Export import support information", page 7-52

● Functions of batch transmission sensor settings

(1) Read sensor settings

The parameters registered to the setup batch transmission sensor settings are read from multiple sensors (adapters) registered in the scan list, and then store them in the assigned device.

(2) Write sensor settings

The device values assigned to the setup batch transmission sensor settings are written to the writable parameters of multiple sensors (adapters) registered in the scan list.

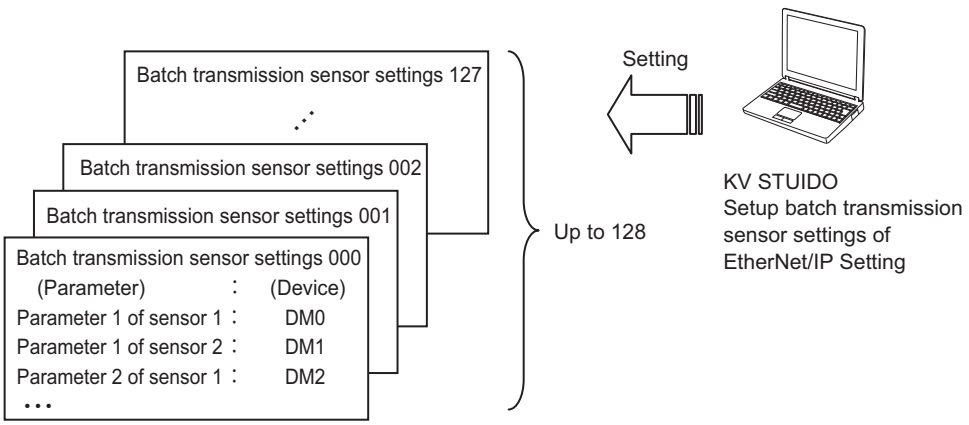
Point

For setup batch transmission sensor settings which include parameters with read attribute, error (inconsistent read/write attribute) may occur during the process of batch write sensor settings. If the batch transmission settings including parameters with read attribute is used to write, but these parameters with read attribute are neglected, the operation continue at error relay should be set to ON.
The parameter attribute can be checked in the "Batch transmission sensor settings" dialog box of EtherNet/IP Setting.

● Setup batch transmission sensor settings

It is the setting of devices that are assigned to the parameters of the sensors (adapters) used in batch transmission sensor settings. And the settings can be completed in the "batch transmission sensor settings" dialog box of EtherNet/IP Setting.
There can be at most 128 (No. 0 to 127) setup batch transmission sensor settings. And the settings used for reading/writing the batch transmission sensor settings will be specified in accordance with their No.s.
With the Ladder program, after specifying setup batch transmission sensor settings, and setting the read/write execution request relay to ON, the parameters registered in the setup batch transmission sensor settings of specified No. will be read (sensor ->device)/written (device -> sensor) in batch.
The devices assigned to the batch transmission sensor settings are R, MR, LR, B, DM, EM*, FM*, ZF* and W.
* EM, FM and ZF cannot be used when KV-NC1EP is being used.

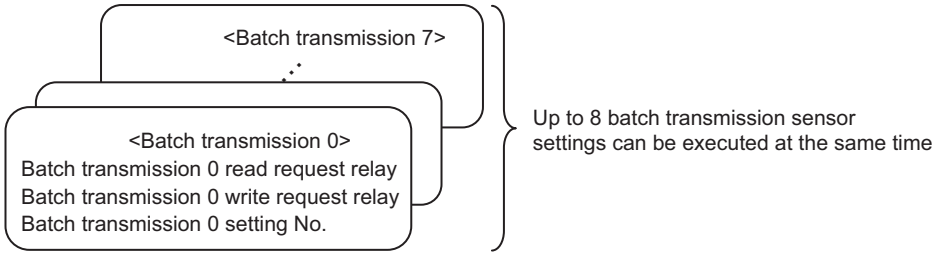
"Setup batch transmission sensor settings", page 7-51



Assign device to settings of adapter unit registered in scan list.

● How to execute batch transmission sensor settings

When the execution request relay assigned to the device is ON, the parameters registered in the batch transmission sensor settings will be read/written in batch.
Since there are 8 execution request relays, 8 batch transmission sensor settings can be executed.



"Devices used in Batch Transmission Sensor Settings Function", page 7-55

● Export the import support information of setup batch transmission sensor settings

The import support information file can be exported through the "Setup batch transmission sensor settings" dialog box of EtherNet/IP Setting. The import support information file can be edited with the PLC data folder of the drawing software VT STUDIO or data acquisition software KV COM+ of VT3 Series touch panel display.
When the import support information files are used in the PLC data folder edit tool, not only the name or the value range/meaning of the parameters of the sensors can be checked, but also the record data can be edited.

"Export import support information", page 7-52

● Unit-specific command/function related to batch transmission sensor settings function

Unit-specific commands/functions for programming are available for batch transmission sensor settings function, and specifying buffer memory address assigned is not required.

"Unit-specific Command/Function for Batch Transmission Sensor Settings Function", page 7-67

● Process and log monitor of batch transmission sensor settings function

The execution status and log of backup sensor settings and batch transmission sensor settings can be checked in the Unit Monitor of KV STUDIO.

"Chapter 15 MONITOR"

The latest 16 operation logs of backup sensor settings and batch transmission sensor settings will be respectively recorded in CPU unit.

Setting Details of Batch Transmission Sensor Settings

The following describes the settings related to batch transmission sensor settings function.
For common settings with other functions of sensor application, see appropriate pages.

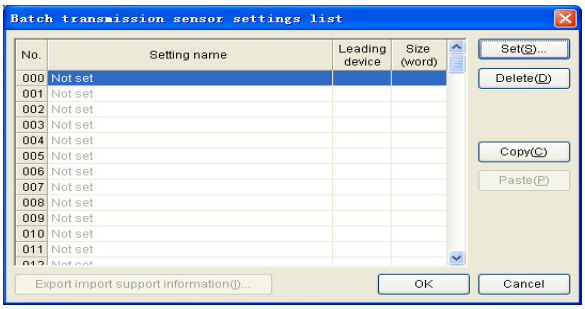
"Settings in Unit Editor Related to Sensor Application", page 7-4
"Scan List Settings", page 4-12
"Compatibility Check for Sensor Application", page 7-5

■ Setup batch transmission sensor settings

Set up the batch transmission sensor settings.
The settings can be executed in the "batch transmission sensor settings list" dialog box of EtherNet/IP Setting.

1 Click [Setting(S)] -> [Setup batch transmission sensor settings(S)] in the menu of EtherNet/IP Setting.

The "Setup batch transmission sensor settings" dialog box will appear.



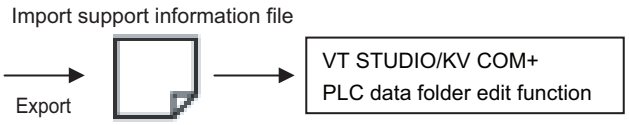
Item	Description
No.	Specify this No. as the setting No. of batch transmission sensor settings (0 to 127)
Setting name	To display the setting name. For the default setting, the No. will be displayed following the batch transmission sensor settings. (e.g., if the No. is 000, batch transmission sensor settings 000 will be displayed). The setting name can be changed. If there is no setting, "not set" will be displayed.
Leading device	To display the leading device assigned. Leading device can be assigned for each setting.
Size (word)	To display the size (in word) of the devices assigned for each setting.
"Set"	To set up the setup batch transmission sensor settings of selected No..
"Delete"	To delete the setup batch transmission sensor settings of selected No..
"Copy"	To copy the contents of the setup batch transmission sensor settings of selected No..
"Paste"	To paste the copied contents to the setup batch transmission sensor settings of selected No..
"Export import support information"	Export the import support information file used in PLC data folder edit tool of the drawing software VT STUDIO or data acquisition software KV COM+ of VT3 Series.

● Export import support information

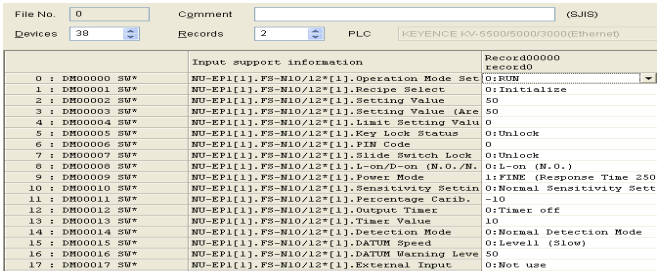
When the import support information files are imported through the PLC data folder edit function of the drawing software VT STUDIO or data acquisition software KV COM+ of VT3 Series touch panel display, not only the name or the value range/meaning of the parameters of the sensors can be checked, but also the record data can be edited.

Setup batch transmission sensor settings

Batch transmission sensor settings 000	
(Parameter)	: (Device)
Parameter 1 of sensor 1	: DM0
Parameter 1 of sensor 2	: DM1
Parameter 2 of sensor 1	: DM2
•••	



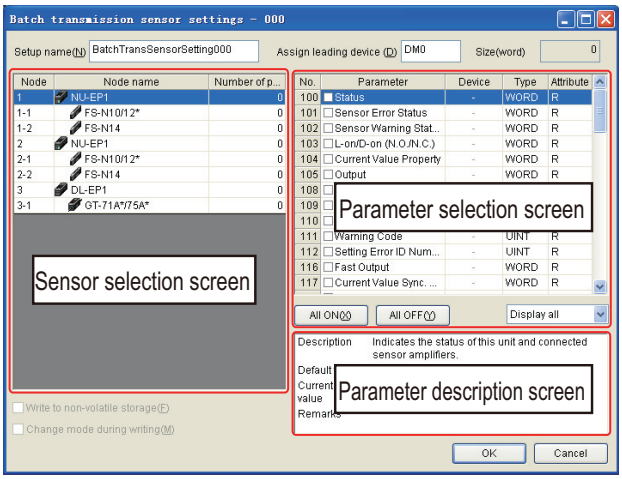
VT STUDIO [PLC data folder edit tool]


File No. 0 Comment (SJIS)
Devices 38 Records 2 PLC KEYENCE KV-5500/5000/3000(Ethernet)

	Input support information	Record00000 record0
0 : DM00000 SW*	NU-EP1[1].FS-N10/12*[1].Operation Mode Set	0:RUN
1 : DM00001 SW*	NU-EP1[1].FS-N10/12*[1].Recipe Select	0:Initialize
2 : DM00002 SW*	NU-EP1[1].FS-N10/12*[1].Setting Value	50
3 : DM00003 SW*	NU-EP1[1].FS-N10/12*[1].Setting Value (Are	50
4 : DM00004 SW*	NU-EP1[1].FS-N10/12*[1].Limit Setting Valu	0
5 : DM00005 SW*	NU-EP1[1].FS-N10/12*[1].Key Lock Status	0:Unlock
6 : DM00006 SW*	NU-EP1[1].FS-N10/12*[1].PIN Code	0
7 : DM00007 SW*	NU-EP1[1].FS-N10/12*[1].Slide Switch Lock	0:Unlock
8 : DM00008 SW*	NU-EP1[1].FS-N10/12*[1].L-on/D-on (N.O./N.	0:L-on (N.O.)
9 : DM00009 SW*	NU-EP1[1].FS-N10/12*[1].Power Mode	1:FINE (Response Time 250
10 : DM00010 SW*	NU-EP1[1].FS-N10/12*[1].Sensitivity Settin	0:Normal Sensitivity Sett
11 : DM00011 SW*	NU-EP1[1].FS-N10/12*[1].Percentage Carib.	-10
12 : DM00012 SW*	NU-EP1[1].FS-N10/12*[1].Output Timer	0:Timer off
13 : DM00013 SW*	NU-EP1[1].FS-N10/12*[1].Timer Value	10
14 : DM00014 SW*	NU-EP1[1].FS-N10/12*[1].Detection Mode	0:Normal Detection Mode
15 : DM00015 SW*	NU-EP1[1].FS-N10/12*[1].DATUM Speed	0:Levell (Slow)
16 : DM00016 SW*	NU-EP1[1].FS-N10/12*[1].DATUM Warning Leve	50
17 : DM00017 SW*	NU-EP1[1].FS-N10/12*[1].External Input	0:Not use

2 Select a No. to be set, and click the "setting" button.

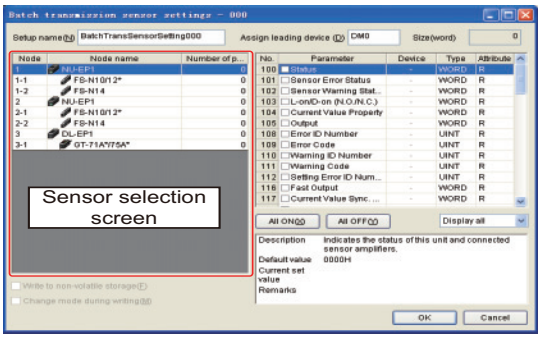
The "Batch transmission sensor settings" dialog box will appear.



Item	Description
Set name	To display the setting name. When a new setting is created, the No. will be displayed following the batch transmission sensor settings. (e.g., if the No. is 000, batch transmission sensor settings 000 will be displayed.) Setting range: <= 32 half-width characters
Assign leading device	To specify the leading device of setup batch transmission sensor settings. It can be R/MR/LR/B/DM/EM*/FM*/ZF*/W. When specifying bit device, the leading No. of the channel should be specified.
Write to non-volatile storage	It will be displayed if the sensor which requires to write setting changes to non-volatile storage is selected. If checked, write the batch transmission sensor settings to non-volatile storage.
Change mode during writing	It will be displayed if the sensor which requires to change its mode in case of setting change is selected. If checked, sensor mode will be changed while the batch transmission sensor settings is written.
"Sensor selection screen"	To select the sensor. The parameters of the selected sensors here will be displayed in the parameter selection screen.
"Parameter selection screen"	To select parameters. Devices will be automatically assigned to the checked parameters.
"Parameter description screen"	Information about the defined parameters of each sensor will be displayed.

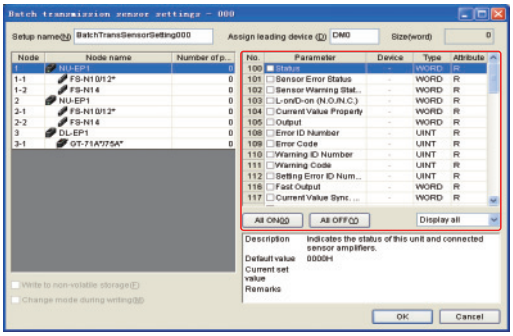
* EM, FM and ZF cannot be used when KV-NC1EP is being used.

3 Select the sensor registered in the sensor selection screen.



Item	Description
Node	To display the node address and slot No..
Node name	To display the node name.
Number of params	To display the number of parameters assigned to setup batch transmission sensor settings.

4 Select the parameter registered in the parameter selection screen.



Parameter selection screen

Item	Description
No.	To display parameter No.
Parameter	To display parameter name defined in adapter EDS file. The checked parameter will be the object of batch transmission sensor settings. Devices will be automatically assigned to the checked parameters.
Device	To display the devices assigned to the parameters.
Type	To display data type of parameters defined in EDS file. "Supported data type", page 7-103
Attribute	To display attribute of parameters defined in EDS file. R: read, R/W: read/write
Display all	To display parameters in folder manner. Display all: display all parameters. Display only R/W: display only the parameters with R/W attribute.
[All ON]	To select all parameters.
[All OFF]	To unselect all parameters.

5 Repeat step 3 to 5 to set up the parameters of multiple sensors.

Devices used in Batch Transmission Sensor Settings Function

■ Relay

n: Leading relay No.

Relay No.	Name	Function	R/W
n+200 to n+207	Batch transfer (0 to 7) read req*1	OFF->ON: execute batch transmission read to the settings specified by the "setting No. of batch transmission sensor settings (0 to7)" of DM.	W
n+208 to n+315	Reserved for system	Unavailable	-
n+400 to n+407	Batch transfer (0 to 7) write req *1	OFF -> ON: execute batch transmission write to the settings specified by the "setting No. of batch transmission sensor settings (0 to7)" of DM.	W
n+408 to n+415	Reserved for system	Unavailable	-
n+500 to n+507	BatchTrans(0 to 7) Continue at err	ON: the execution will continue in case of error during reading/writing batch transmission sensor settings (0 to 7). OFF: the execution will immediately stop in case of error during reading/writing batch transmission sensor settings (0 to 7).	W
n+508 to n+515	Reserved for system	Unavailable	-
n+600 to n+607	Batch transfer (0 to 7) break req	OFF -> ON: abort the ongoing batch transmission sensor settings (read/write). This will be ignored in case of no batch transmission sensor settings (read/write). If the request relay is ON during the process of interrupt request relay ON, transmission will be interrupted immediately.	W
n+608 to n+615	Reserved for system	Unavailable	-
n+1200 to n+1207	Batch transfer (0 to 7) read end	ON :it will be ON upon the completion of the requested processing. ON->OFF: it will be OFF when request relay is ON->OFF.	R
n+1208 to n+1215	Reserved for system	Unavailable	-
n+1300 to n+1307	Batch transfer (0 to 7) read fail	ON: when there is error in processing the request, it will be ON at the time that is the same as complete relay. ON->OFF: it will be OFF when request relay is ON->OFF.	R
n+1308 to n+1315	Reserved for system	Unavailable	-
n+1400 to n+1407	BatchTrans(0 to 7) write end	ON: it will be ON upon the completion of the requested processing. ON->OFF: it will be OFF when request relay is ON->OFF.	R
n+1408 to n+1415	Reserved for system	Unavailable	-
n+1500 to n+1507	Batch transfer (0 to 7) write fail	ON: when there is error in processing the request, it will be ON at the time that is the same as complete relay. ON->OFF: it will be OFF when request relay is ON->OFF.	R
n+1508 to n+1515	Reserved for system	Unavailable	-

Relay No.	Name	Function	R/W
n +1600 to n +1607	Batch transfer (0 to 7) in progress	ON: the batch transmission sensor settings (read/write) is being executed.	R
n +1608 to n +1615	Reserved for system		-

***1 If the write/read request relay is OFF->ON during the process of reading/writing batch transmission sensor settings of the same group, the execution will fail when an execution request error occurs.**

■ DM

N: Leading relay No.

DM No.	Name		Function	R/W
N +126	Batch transfer 0 set No.		Specify the setting No. when executing batch transmission sensor settings 0 to 7.	W
N +127 to N +133	Batch transfer (1 to 7) set No.			W
N +134	Batch transmission sensor settings 0 read	BatchTrans0 read comp code	Store complete code.	R
N +135		BatchTrans0 read detailCompCode	Store detailed complete code.	R
N +136		BatchTrans0 read err node addr	When the requested processing is completed with error, store the last error node address. When it succeeds, or the errors irrelevant to the node occur, store 0.	R
N +137		BatchTrans0 read err slot No.	When the requested processing is completed with error, store the last error slot No.. When it succeeds, or the errors irrelevant to the sensor occur, store 0.	R
N +138		BatchTrans0 read err param No.L/H	When the requested processing is completed with error, store the last error parameter No.. When it succeeds, or the errors irrelevant to the parameter occur, store 0.	R
N +139				
N +140	Batch transmission sensor settings 0 write	BatchTrans0 write comp code	Store complete code.	R
N +141		BatchTrans0 write detailCompCode	Store detailed complete code.	R
N +142		BatchTrans0 write err node	When the requested processing is completed with error, store the last error node address. When it succeeds, or the errors irrelevant to the node occur, store 0.	R
N +143		BatchTrans0 write err slot No.	When the requested processing is completed with error, store the last error slot No.. When it succeeds, or the errors irrelevant to the sensor occur, store 0.	R
N +144		BatchTrans0 write err param No.L/H	When the requested processing is completed with error, store the last error parameter No.. When it succeeds, or the errors irrelevant to the parameter occur, store 0.	R
N +145				
N +146 to N +151	Batch transmission sensor settings 1 read		Same as batch transmission sensor settings 0 read	R
N +152 to N +157	Batch transmission sensor settings 1 write		Same as batch transmission sensor settings 0 write	R

DM No.	Name	Function	R/W
N +158 to N +163	Batch transmission sensor settings 2 read	Same as batch transmission sensor settings 0 read	R
N +164 to N +169	Batch transmission sensor settings 2 write	Same as batch transmission sensor settings 0 write	R
N +170 to N +175	Batch transmission sensor settings 3 read	Same as batch transmission sensor settings 0 read	R
N +176 to N +181	Batch transmission sensor settings 3 write	Same as batch transmission sensor settings 0 write	R
N +182 to N +187	Batch transmission sensor settings 4 read	Same as batch transmission sensor settings 0 read	R
N +188 to N +193	Batch transmission sensor settings 4 write	Same as batch transmission sensor settings 0 write	R
N +194 to N +199	Batch transmission sensor settings 5 read	Same as batch transmission sensor settings 0 read	R
N +200 to N +205	Batch transmission sensor settings 5 write	Same as batch transmission sensor settings 0 write	R
N +206 to N +211	Batch transmission sensor settings 6 read	Same as batch transmission sensor settings 0 read	R
N +212 to N +217	Batch transmission sensor settings 6 write	Same as batch transmission sensor settings 0 write	R
N +218 to N +223	Batch transmission sensor settings 7 read	Same as batch transmission sensor settings 0 read	R
N +224 to N +229	Batch transmission sensor settings 7 write	Same as batch transmission sensor settings 0 write	R

For the complete codes and detailed complete codes of various functions, see "List of the Complete Codes of the Sensor Application Functions", page 7-96.

■ Buffer memory

Buffer memory address	Name		Function	R/W
#1700	Batch transmission sensor settings 0	Batch Trans0 executing set No.	Store the setting No. of batch transmission sensor settings 0 in execution. Keep the last executed No. when the transmission completes. Store FFFF (H) in case of power ON, unit setting change or restart with reset service.	R
#1701		BatchTrans0 num of object sensor	Store the number of object sensors involved in the ongoing batch transmission sensor settings 0. The adapters reserved as EtherNet/IP Device are not included in the number of the sensors.	R
#1702		BatchTrans0 num of executed sensor	Store the number of sensors having completed batch transmission sensor settings. The sensors that are not processed due to operation continue at error or have errors during parameter processing are included. The adapters reserved as EtherNet/IP Device are not included in the number of the sensors.	R
#1703		BatchTrans0 max time node addr	Store the node address, slot No. and processing time (unit: 0.1s) of the sensor which takes the longest time to complete batch transmission sensor settings 0. In case of no rack configuration unit, the slot No. of the longest processing time will be stored as 0.	R
#1704		BatchTrans0 max time slot No.		R
#1705		BatchTrans0 mas timee		R
#1706		BatchTrans0 whole execute time	Store execution time (unit: 0.1s) of batch transmission sensor settings 0. And it also includes the processing time of the sensors failing in Batch transmission.	R
#1707		BatchTrans0 executing processe	Store execution status of batch transmission sensor settings 0 0: no execution processing (transmission complete) 1: read is processing 2: write is processing	R
#1708 to #1715	Batch transmission sensor settings 1		Same as batch transmission sensor settings 0	R
#1716 to #1723	Batch transmission sensor settings 2		Same as batch transmission sensor settings 0	R
#1724 to #1731	Batch transmission sensor settings 3		Same as batch transmission sensor settings 0	R
#1732 to #1739	Batch transmission sensor settings 4		Same as batch transmission sensor settings 0	R
#1740 to #1747	Batch transmission sensor settings 5		Same as batch transmission sensor settings 0	R
#1748 to #1755	Batch transmission sensor settings 6		Same as batch transmission sensor settings 0	R
#1756 to #1763	Batch transmission sensor settings 7		Same as batch transmission sensor settings 0	R

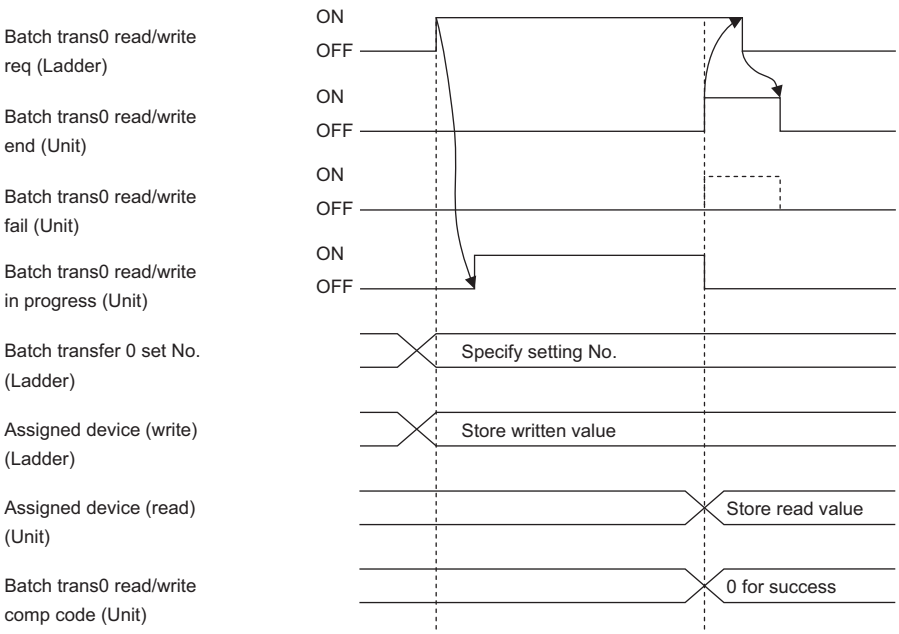
Batch Transmission Sensor Settings Read/Write Steps and Reference Program

The following describes the procedure and reference program of batch transmission sensor settings. Specify the setting No. of batch transmission sensor settings, and set transmission request relay to ON.

● Steps

Here, setup batch transmission sensor settings of No. 0 is taken as example to describe the batch transmission sensor settings read/write procedure. When using the devices of other groups (1-7), please use them after changing their name.

"Devices used in Batch Transmission Sensor Settings Function", page 7-55



(1) Store setting No. used for batch transmission sensor settings 0 write/read (0 to 127) in batch transmission 0 setting No., and set batch trans0 read/write req relay to ON.

(2) Upon start of batch transmission sensor settings 0 read/write, batch trans0 in progress relay is ON.

(3) Upon completion of batch transmission sensor settings 0 read/write, batch trans0 read/write end relay is ON.

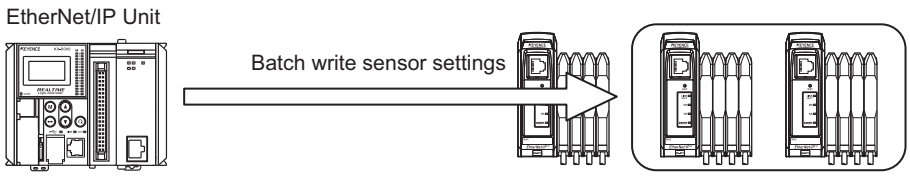
(4) After checking batch trans0 read/write end relay is ON, set the batch trans0 read/write req relay to OFF.

If batch trans0 read/write fail relay is ON, read batch trans0 read/write comp code, and execute error processing.

(5) If the EtherNet/IP Unit detects the batch trans0 read/write req relay is OFF, batch trans0 read/write end relay will change to OFF.

● Reference program

The following describes the sample program used for executing batch write sensor settings to the sensor (EtherNet/IP adapter) registered in the scan list.

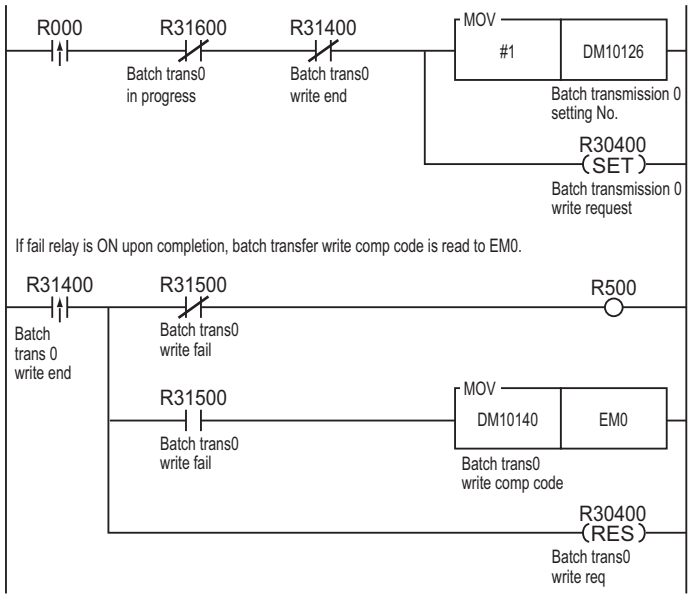


Setting in Unit Editor

Setting items	Description
Leading DM No.	DM10000
Leading relay No.	R30000

E.g.) Take No. 1 setup batch transmission sensor settings as example to execute batch transmission sensor settings write.

Here the devices for batch transmission sensor settings 0 are used.



(Mnemonic list)

```
LDP R000
ANB R31600
ANB R31400
MOV #1 DM10126
SET R30400
LDP R31400
MPS
ANB R31500
OUT R500
MRD
AND R31500
MOV DM10140 EM0
MPP
RES R30400
```

■ Procedure and reference program for interrupt processing of batch transmission sensor settings

The following describes the procedure and reference program for interrupt processing of batch transmission sensor settings (read/write).

● Operation during execution of interrupt processing

Execute the interrupt processing by parameter.
Therefore, possibly interrupt occurs when batch transmission (read/write) has been implemented for certain sensor (adapter) midway parameter. If interrupt processing is executed during execution of batch transmission write, batch transmission write must be executed again.

The operation after of the interrupt processing is show below.

Item		Description
Relay	Batch transmission complete relay	ON
	Batch transmission fail relay	
DM	Complete code	10605 (Interrupt error based on interrupt request)
	Detailed complete code	0 (Fixed value)
	Error node address	
	Error slot No.	
	Error parameter No.	
Buffer memory	Longest processing time node address	Store the sensor results including those processed with the interrupt request.
	Longest processing time slot No.	
	Longest processing time	
	Total execution time	
	Number of execution complete sensors	The number of sensors processed is stored. Sensors processed in the interrupt request are excluded.

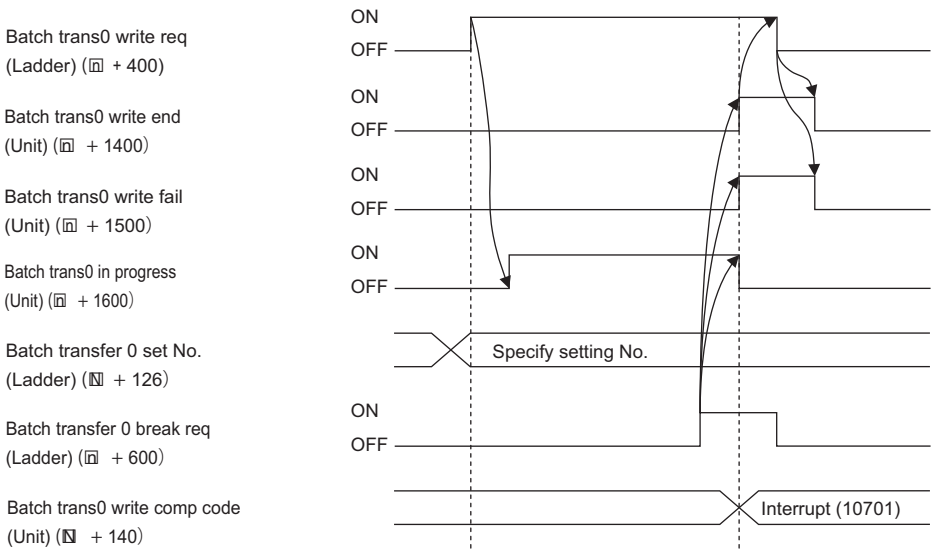
Point

- **When executing interrupt request, it will be interrupted will occur immediately even if the operation continue at batch transmission (0 to 7) error relay is ON.**
- **If interrupt occurs during batch transmission read, settings of parameters read before interrupt will be written to device.**

● Interrupt processing procedure

The following describes interrupt processing procedure during execution of batch transmission sensor settings write.

If interrupt occurs during execution of batch transmission sensor settings read, please change device name and then use it.



(1) Store setting No. used for batch transmission sensor settings 0 write in batch transmission 0 setting No., and set batch trans0 write req relay to ON.

(2) Upon start of batch transmission sensor settings 0 write, batch trans0 in progress relay is ON.

(3) Set batch transmission 0 interrupt processing request relay to ON.

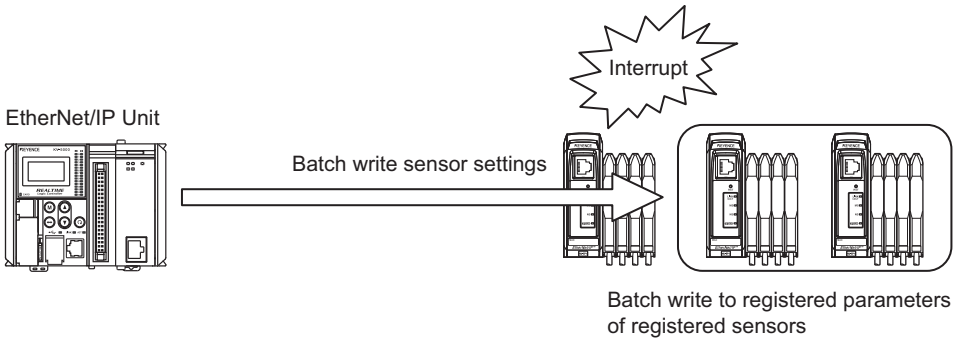
(4) Upon interrupt of batch write sensor settings, batch transmission 0 write complete relay, and batch transmission 0 write to fail relay are ON, and batch trans0 in progress relay is OFF.

(5) After checking batch transm0 write end relay is ON, the batch trans0 write req relay and batch trans0 break req relay are OFF.

(6) If the EtherNet/IP Unit detects the batch trans0 write req relay is OFF, the batch transmission sensor settings 0 write complete relay will change to OFF.

● Reference program

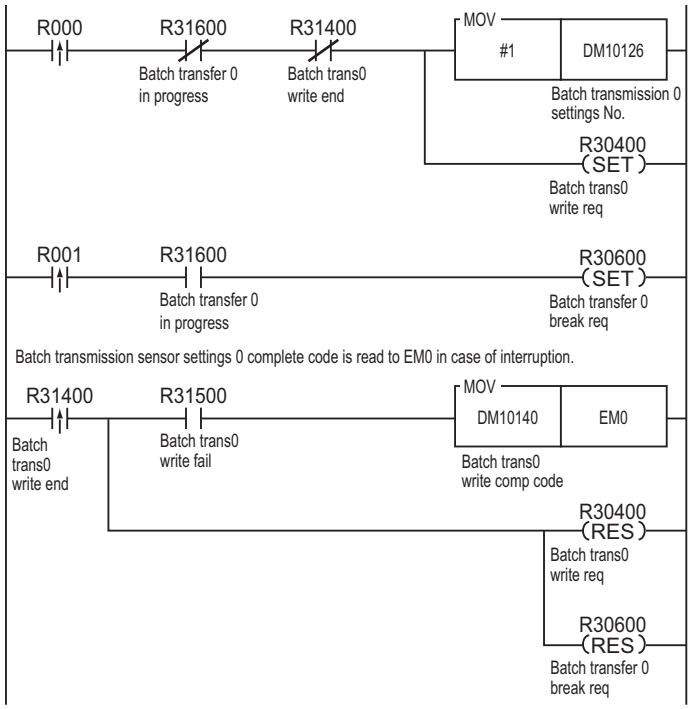
The following describes the sample program when interrupt occurs during batch write sensor settings to the sensor (EtherNet/IP adapter) registered in the scan list.



Setting in Unit Editor

Setting items	Description
Leading DM No.	DM10000
Leading relay No.	R30000

E.g.) Execute interrupt during batch transmission sensor settings write.



(Mnemonic list)

```
LDP R000
ANB R31600
ANB R31400
MOV #1 DM10126
SET R30400
LDP R001
AND R31600
SET R30600
LDP R31400
MPS
AND R31500
MOV DM10140 EM0
MRD
RES R30400
MPP
RES R30600
```

Notice on using Batch Transmission Sensor Settings Function

■ Simultaneous execution of batch transmission sensor settings

8 groups of devices for execution are available, therefore, up to 8 batch transmission sensor settings can be executed.

However, batch read sensor settings and batch write sensor settings in the same group cannot be executed.

E.g.) During execution of batch transmission sensor settings 0 write, batch transmission sensor settings 0 read can not be executed.

■ Notice on simultaneous execution of batch transmission sensor settings

Notices on simultaneous execution of batch transmission sensor settings from different groups are described.

● Simultaneous read when batch transmission sensor settings with the same setting No. is used

If the same setting No. is specified to setup batch transmission sensor settings to which batch read is executed, other batch read sensor settings can also be executed.

E.g.) During execution of batch transmission sensor settings read of setting No. 0 by specifying the same setting No. 0, other read can be executed.

Point

No error will occur when batch transmission sensor settings write is executed simultaneously for the same setting No., however, write processing sequence can not be guaranteed.

● Simultaneous execution of batch transmission sensor settings including the same sensor (node address)

EtherNet/IP Units can execute only 1 message send to 1 sensor (adapter). Therefore, if read/write processing for the same sensor (adapter) occurs when executing multiple batch transmission sensor settings, it should be executed by occurrence sequence.

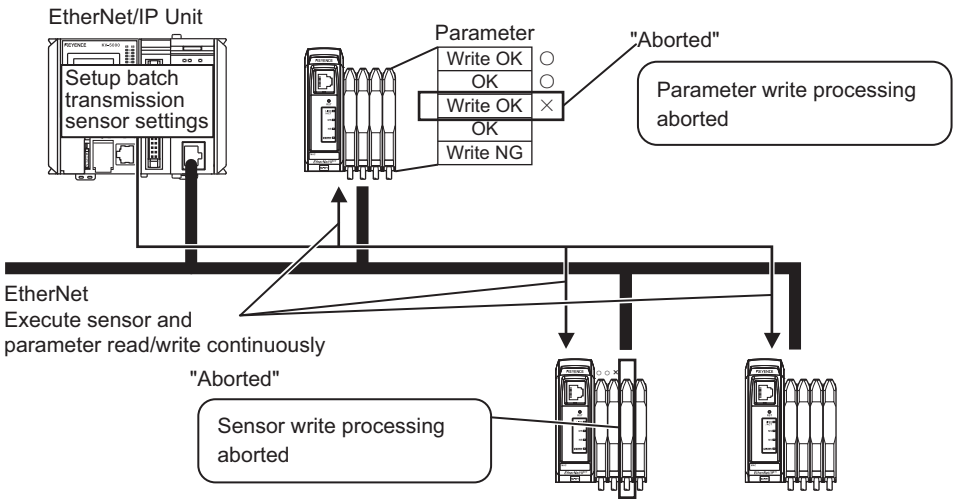
"Simultaneous Execution of Sensor Application Functions", page 7-4

● Number of simultaneous executions quantity for different sensors (node addresses)

During execution of batch transmission sensor settings, parameter read/write can be executed simultaneously for up to 16 sensors (adapters). If number of object nodes of the executing batch transmission sensor settings is 17 or more, processing of the sensors beyond 16 is kept, and will be executed after completing read/ write of certain sensor.

■ Setting of operation at error

When executing batch transmission sensor settings, the setting read/write can be executed continuously for multiple parameters of multiple sensors (adapters). Therefore, the communication error with part of sensors (adapters) or read/write error of specific parameter will be detected as the error of batch transmission sensor settings execution. If read/write error of part parameters occurs in the process of execution, it can be set to stop batch transmission sensor settings when error occurs, or set to continue to read/write other sensors (adapters) or parameters.



● Setting method for operation continue at error

Set operation continue at batch transmission error relay to ON. Under the status that operation continue at batch transmission error relay is ON, if execution request relay is set to ON, the operation will continue when error occurs. After execution request relay is set to ON, even if operation continue at batch transmission error relay is set to ON, the operation can not continue when error occurs.

- **Not continue (operation continue at error relay is OFF)**
  : stop execution when error occurs, complete bit and execution fail relay is ON, and error causes are stored in the assigned DM *.
- **Continue (operation continue at error relay is ON)**
  : when error occurs, batch transmission sensor settings function of other sensors or parameters will continue. After all processing has completed and the execution fail relay is ON, the cause of the last error occurred will be stored in the assigned DM*.

* store the complete code, detailed complete code, error parameter No., error node address No. and error slot No..

Point

In the event of the operation not continue at error, the processing of other sensors (adapters) in the parallel will also stop; therefore, the processing of parameter read/ write of the sensor (adapter) will also stop at halfway.

● Operation in case of operation continue at error

If operation when error occurs continues, according to the causes for error occurred, the operation is as follows.

Cause of error	Operation
Error (function)	For batch transmission sensor settings function error, operation cannot be continued. Execution is stopped immediately.
Error (node)	Error occurs on communication with node (adapter, communication adapter in case of rack configuration unit). Continue processing for the next node. In case the slot unit exists, the rest parameters of the sensor processed when error occurs and the parameters of the rest sensors (slot unit) are not processed.
Error (sensor)	Communication error with sensors (the slot unit of rack configuration unit). Continue processing for the next sensor (slot unit). The rest parameters of the error sensor (slot unit) shall be left unprocessed.
Error (parameter)	The error occurs in processing specific parameter. Continue processing for the next parameter No..

* For the causes of error occurred, see"List of the Complete Codes of the Sensor Application Functions", page 7-96

Unit-specific Command/Function for Batch Transmission Sensor Settings Function

■ Unit-specific command/function list for batch transmission sensor settings function

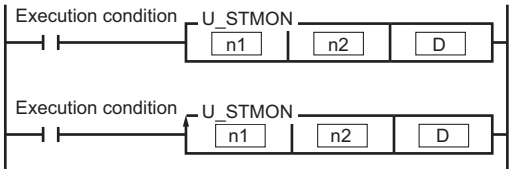
Function	Command	Operation	Page
Acquire execution status of batch transmission sensor settings	U_STMON	Read execution status of batch transmission sensor settings from buffer memory.	7-68

■ Unit-specific function list for batch transmission sensor settings function

Function	Command	Operation	Page
Acquire execution status of batch transmission sensor settings	U_STMON	Read execution status of batch transmission sensor settings from buffer memory.	7-70

U_STMON	**U_STMON(.U)**	U_STMON	Acquire execution status of batch transmission sensor settings
@U_STMON	**@U_STMON(.U)**	U_STMON	Read execution status of batch transmission sensor settings from buffer memory.

Ladder program



Input method

U _ S T M O N ␣ n1 ␣ D ↵

@ U _ S T M O N ␣ n1 ␣ D ↵

Operand	Available device																			Index Modification
	Bit device							Word device								Constant	Indirect specifying		Local Bit device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
n2	○	-	○	-	-	-	○	○	○*4	○	○	○	○	○	○	-	-	○	○	○
D	○	-	○	-	-	-	○	○	○*4	○	○	-	-	-	○	-	-	○	○	○

Operand	Description
n1	Specify unit No. (0-63, KV-5500: "0"). $ cannot be used.
n2	Specify batch transmission sensor settings No. (0 to 7) or its storage device. *1
D	Specify the leading device to store execution status. *2*3

*1 If the bit device is specified for n2, consecutive 16 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

*2 If bit device is specified for D, consecutive 128 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 128 bits will be processed by crossing over to the next channel.

*3 If word device is specified, consecutive 8 words will be processed.

*4 EM, FM and ZF cannot be used with the KV Nano Series.

Operation Description

U_STMON If execution condition is ON, read the execution status of batch transmission sensor settings n2 of No. n1 unit from the buffer memory, and store it in 8 words with D as leading devices.

Execution status	Buffer memory address	Device No.
Batch transmission n2 Execution in progress setting No.	#1700 + 8 x n2	D + 0
Batch transmission n2 Number of object sensors	#1701 + 8 x n2	D + 1
Batch transmission n2 Number of execution complete sensors	#1702 + 8 x n2	D + 2
Batch transmission n2 Longest processing time node address	#1703 + 8 x n2	D + 3
Batch transmission n2 Longest processing time slot No.	#1704 + 8 x n2	D + 4
Batch transmission n2 Longest processing time	#1705 + 8 x n2	D + 5
Batch transmission n2 Total execution time	#1706 + 8 x n2	D + 6
Batch transmission n2 Execution in progress processing	#1707 + 8 x n2	D + 7

@U_SBMON At the rising edge of the execution condition, the scan will be executed only once.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON if any of the following conditions is met, otherwise it is OFF. • The unit No. specified by n1 is out of range. • The unit with the unit No. specified with n1 is not KV-EP21V, KV-5500 or KV-NC1EP. • Batch transmission sensor settings No. specified by n2 is more than 8. • From the device specified by D, 8-word device cannot be guaranteed. • The range of indirect specifying and index modification are inappropriate.

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

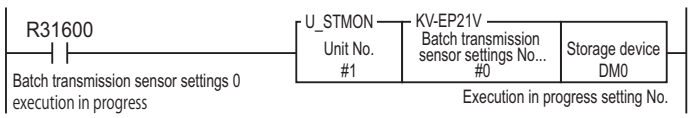
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

Sample Program

During execution of batch transmission sensor settings 0, store execution status in DM0 to DM7.



(Mnemonic list)

```
LD R31600
U_STMON #1 #0 DM0
```

U_STMON Acquire execution status of batch transmission sensor settings

U_STMON ([execution condition]*1, unit No., batch transmission sensor settings No., storage location device No.)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n1	Unit No.*2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	-
n2	Batch transmission sensor settings No.	Specify batch transmission sensor settings No..	.U	.U	.U	.U	-	-	-	-	-	○	-
D	Storage device No.*3*4*5	Specify the leading device No. to store execution status.	.U	.U	.U	.U	-	-	-	-	-	○	-

*1 [ ] can be omitted. (If execution condition is omitted, the function is execute in each scanning)

*2 $ (specify hex) can not be used.

*3 It cannot be specified for CTC, CTH and Z.

*4 If the bit device is specified for D, consecutive 128 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 128 bits will be processed by crossing over to the next channel.

*5 If word device is specified for D, consecutive 8 words will be processed.

Operation Description

U_STMON If execution condition is ON, read the execution status of batch transmission sensor settings n2 from No. n1 unit, and store it in 8 words with D as leading device.

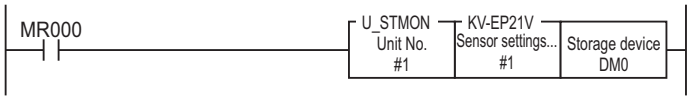
Execution status	Buffer memory address	Device No.
Batch transmission n2 Execution in progress setting No.	#1700+ 8x n2	D + 0
Batch transmission n2 Number of object sensors	#1701+ 8x n2	D + 1
Batch transmission n2 Number of execution complete sensors	#1702+ 8x n2	D + 2
Batch transmission n2 Longest processing time node address	#1703+ 8x n2	D + 3
Batch transmission n2 Longest processing time slot No.	#1704+ 8x n2	D + 4
Batch transmission n2 Longest processing time	#1705+ 8x n2	D + 5
Batch transmission n2 Total execution time	#1706+ 8x n2	D + 6
Batch transmission n2 Execution in progress processing	#1707+ 8x n2	D + 7

- **Format example**

Script U_STMON(MR0,1,1,DM0)

Operation If MR000 is ON, store execution status of sensor batch transmission in DM0 to DM7.

Ladder



7-7 Sensor Setting Commands

This section describes sensor setting command.

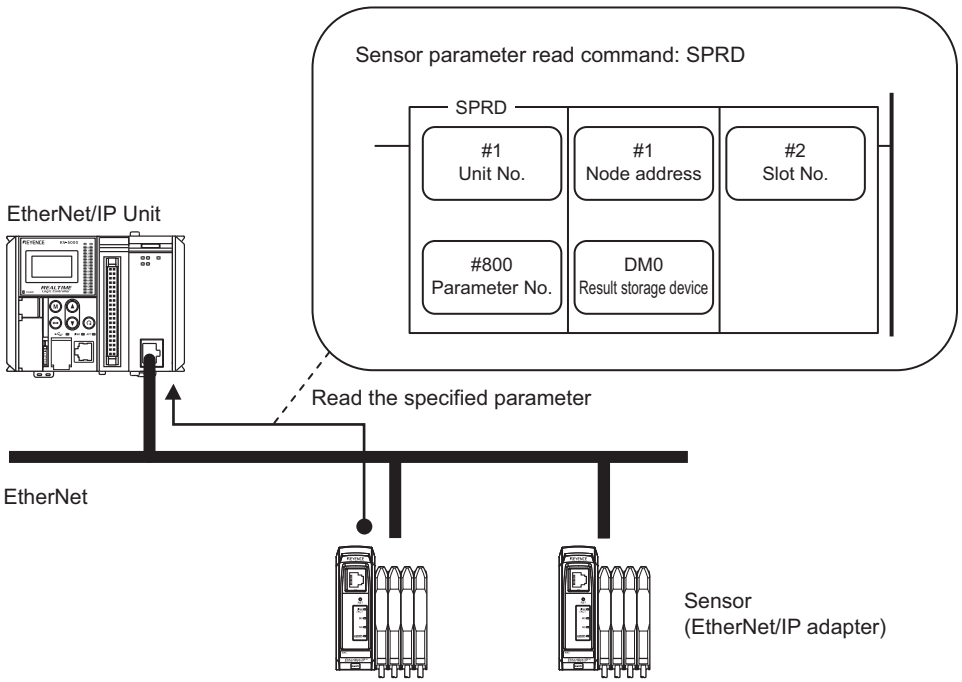
Overview

Sensor setting commands are specially used for read/write of settings of sensor (adapter) registered in the scan list, or for execution of intrinsic services (functions) of sensor.
Using sensor setting command, functions can be executed without program for explicit messages (client).

■ Sensor parameter read/write command

● Sensor parameter read command: SPRD

Using SPRD command (sensor parameter read), the parameter of specified sensor (adapter) can be read, and stored in the device specified by command.



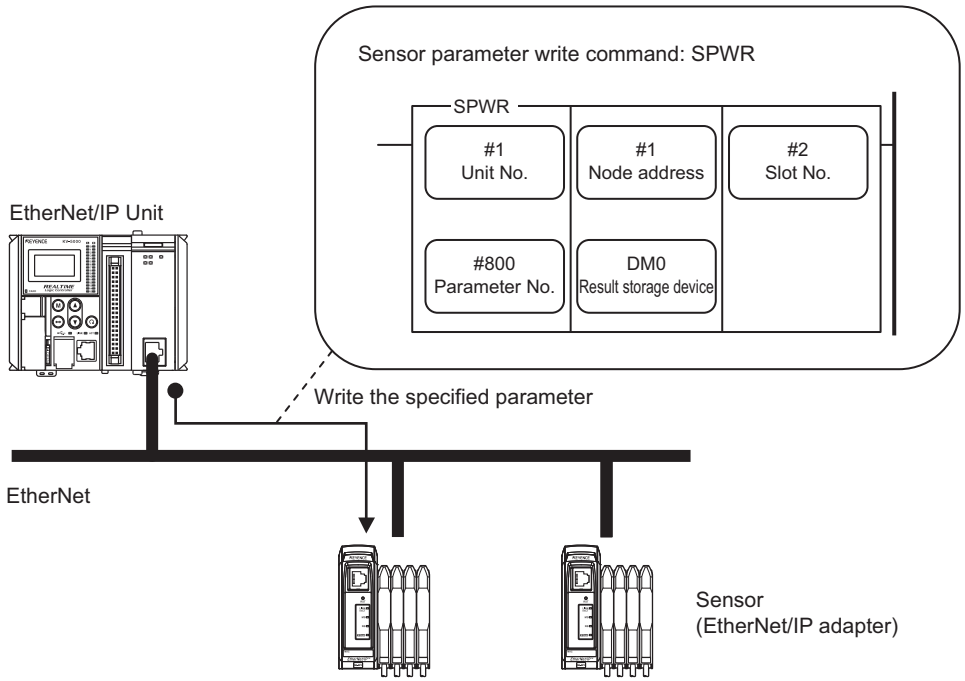
Point

- **You can use sensor parameter read command to read 1 parameter each time.**
- **Sensor parameter read command executes Get_Attribute_Single service to sensors (adapters). (In case of units from KEYENCE, some different services are used))**

SPRD command (sensor parameter read) (page 7-76)
SPRD function (sensor parameter read) (page 7-90)

● Sensor parameter write command: SPWR

Using SPWR command (sensor parameter write), the device value specified by command can be written to the parameter of specified sensor.



Point

- **You can use sensor parameter write command to write 1 parameter each time.**
- **Sensor parameter write command executes Set_Attribute_Single service to sensors (adapters). (In case of units from KEYENCE, some different services are used))**

SPWR command (sensor parameter write) (page 7-80)
SPWR function (sensor parameter write) (page 7-92)

● Available parameter for sensor parameter read/write command

For EtherNet/IP Devices from KEYNECE

For available parameters see appropriate unit manuals.

The sensor and parameter can be used are the sensor and parameter (parameter No. is below 65535) displayed in dialog box of "Setup batch transmission sensor settings" of EtherNet/IP Setting.

For Ethernet units from companies other than KEYNECE

The sensor and parameter can be used are the sensor and parameter (parameter No. is below 65535) displayed in dialog box of "Setup batch transmission sensor settings" of EtherNet/IP Setting.

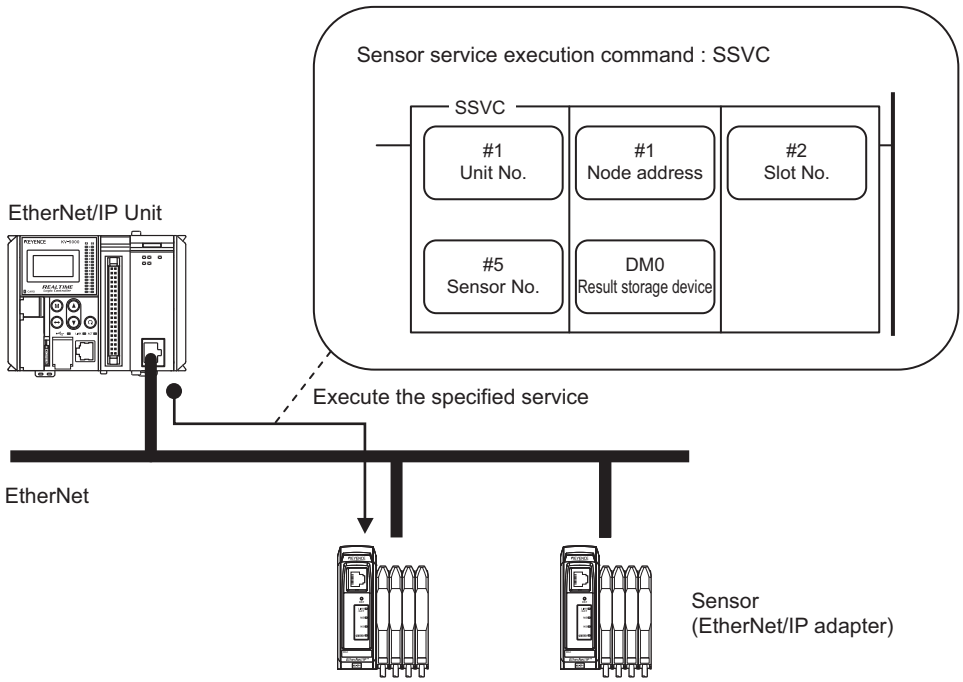
Reference Param No. of [Params] section of EDS file can be used as parameter No..

```
[Params]
        Param100 =
                  0,
                  6,"20 66 24 00 30 64",
                  0x0010,
                  0xD2,
```

■ Sensor service execution command: SSVC (only for EtherNet/IP Devices from KEYNECE)

You can specify service No. specially used by sensor service execution command prepared for sensors (adapters) to execute services.

Please refer to appropriate unit manuals for services prepared for sensors.



SSVC command (sensor service execution) (page 7-84)
SSVC function (sensor service execution) (page 7-94)

● Available services for sensor service execution command

Available services for EtherNet/IP Devices from KEYNECE

For available services, see appropriate unit manuals.

Notice on Sensor Setting Command

The following describes notices when using sensor setting command.

■ Number of simultaneous executions

● Number of simultaneous executions of sensor setting command

A maximum of 16 sensor setting commands can be executed simultaneously.
If 16 sensor setting commands are being executed, even if execution condition of other sensor setting command is specified, the sensor setting command will not be executed. No execution failure will occur. If execution condition is kept ON, when number of sensor setting commands executed simultaneously is less than 16, request will be accepted and command will be executed.
Sensor setting command simultaneously executed is stored in sensor setting command execution quantity (CM1650).

• Sensor setting command execution quantity (CM1650)

CM No.	Name	Function	R/W
CM1650	Sensor setting command execution count	Store number of sensor setting commands executed simultaneously. A maximum of 16 sensor setting commands can be executed simultaneously. Execute add operation during command execution, and execute subtraction operation at END processing.	R

● Simultaneous execution of sensor setting commands when the same sensor (node address) is specified.

EtherNet/IP Units can execute only 1 sensor setting command for 1 sensor (adapter). Therefore, when another sensor setting command is executed for the sensor (adapter) with same node address, add operation will be done to sensor setting command execution quantity, however, during explicit messages of the previous sensor setting command, the processing will be kept. If multiple sensor setting commands are kept, after explicit messages of the executing sensor setting command, these commands will be processed as per execution (programming) sequence from program.

Reference If the same node is as execution condition, and sensor setting commands taking the same node address as object are programmed in parallel, they can be executed in turn from the beginning.

■ Operation of sensor setting command in case of RUN->PROG

During sensor setting command execution, if CPU unit is switched to PROG mode, complete bit is OFF, no update for complete code, and the executing sensor setting command is completed.

■ Compatibility check

When the EtherNet/IP Unit executes message send based on sensor setting command contents of sensors (adapters), it will check the compatibility between the sensor registered in the scan list and the sensor actually connected. If error occurs during compatibility check, sensor setting command will complete.
"Compatibility Check for Sensor Application", page 7-5

■ Error occurred when using sensor setting command

If error occurs when executing sensor setting command, the error details will be stored to complete code specified by commands.
"List of the Complete Codes of the Sensor Application Functions", page 7-96

Sensor Setting Command List

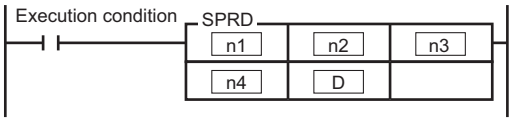
■ Sensor setting command list

Function	Command	Operation	Page
Read sensor parameter	SPRD	Read the parameter of specified sensor.	7-76
Write sensor parameter	SPWR	Write the parameter of specified sensor.	7-80
Execute sensor service	SSVC	Execute service of sensor.	7-84

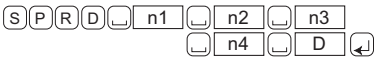
SPRD

SPRD | Read sensor parameter | Read the parameter of specified sensor.

Ladder program



Input method



Operand	Available device																		Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
n2	○	-	○	-	-	-	○	○	○*4	○	○	○	○	○	○	○	-	○	○	○
n3	○	-	○	-	-	-	○	○	○*4	○	○	○	○	○	○	○	-	○	○	○
n4	○	-	○	-	-	-	○	○	○*4	○	○	○	○	○	○	○	-	○	○	○
D	○	-	○	-	-	-	○	○	○*4	-	-	-	-	-	○	-	-	○	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
n2	Specify node address (1 to 256) or its storage device. *1
n3	Specify slot No. or its storage device. In case of other than rack configuration unit or specifying communication adapter, specify 0. *1
n4	Specify parameter No. or its storage device. *1
D	Specify the leading device No. to store complete code or parameter read result. *2*3

***1 If bit device is specified, consecutive 16 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.**

***2 If bit device is specified, please specify the leading device of the channel.**

***3 The number of stored words (more than 4 words) changes depending on execution result.**

***4 EM, FM and ZF cannot be used with the KV Nano Series.**

Point

KV-5500, KV-EP21V and KV-NC1EP can be used.

Operation Description

SPRD

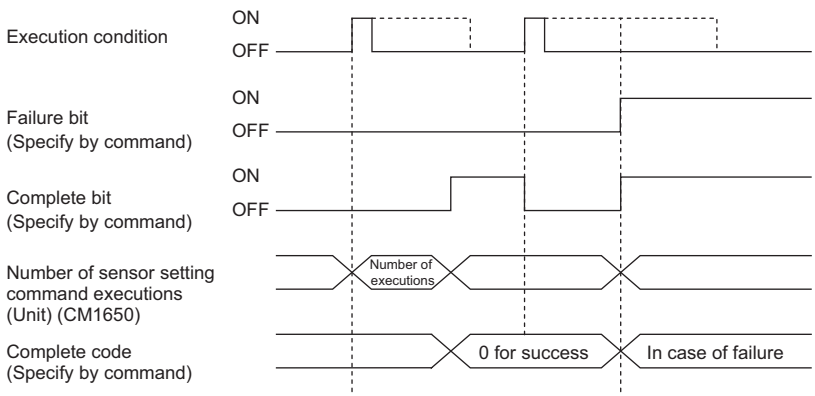
If execution condition is ON, read the parameters specified by sensor n4 (node address n2, slot No. n3) which is connected to No. n1 unit, and upon completion, do storage as follows: bit 0 of D is complete bit, bit 1 of D is execution failure bit, store complete code in D + 1, store detailed complete code in D + 2, store number of array elements (store 1 in case of not array) in D + 3, and store details of read parameters in devices starting from D + 4.

D to : Result storage device

Result storage device			Description
D	Bit 0	complete bit	It is OFF when starting to execute command, and it is ON when parameter read is completed. Whether the command is completed normally or not, it is always ON.
	Bit 1	Execution failure bit	If command execution is failed, both it and complete bit are ON. It is OFF when starting to execute command.
	Bit 2 to 15	Reserved for system	OFF (fixed value)
D +1	Complete code		Upon completion of parameter reading, store complete code. (Normally 0) "List of the Complete Codes of the Sensor Application Functions", page 7-96
D +2	Detailed complete code		Upon completion of parameter reading, store detailed code.
D +3	Number of array elements		Store number of array elements of parameters read. If there is no array, store as 1; if command is completed abnormally, store as 0.
D +4 to	Read result		Store value of parameters. Based on different parameters have been read, the number of occupied data will be changed.

Point

If the sensor reserved as EtherNet/IP Device is specified, execution is failed.

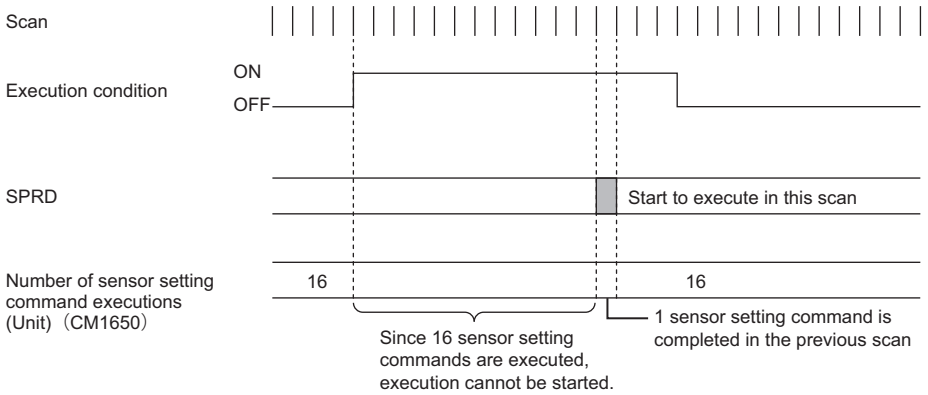


If sensor parameter read command is executed at the rising edge of execution condition, it will continue to process even the input condition is OFF for next scan.

The complete bit and failure bit of result storage device are ON when command is completed, and are OFF when starting to execute command.

Number of sensor setting command executions adds 1 when a command is executed, and subtracts 1 when execution is completed.

When 16 sensor setting commands are executed, even execution condition is set to ON, senor setting command can not be executed. When number of sensor setting commands executed is less than 16, the next senor setting command can be executed.



Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON if any of the following conditions is met, otherwise it is OFF. • The unit with the unit No. specified with n1 is not KV-EP21V, KV-5500 or KV-NC1EP. • From the device specified by D, 4-word device cannot be guaranteed. • If bit device is specified for D, device other than the leading device of the channel is specified. • The range of indirect specifying and index modification are inappropriate.

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

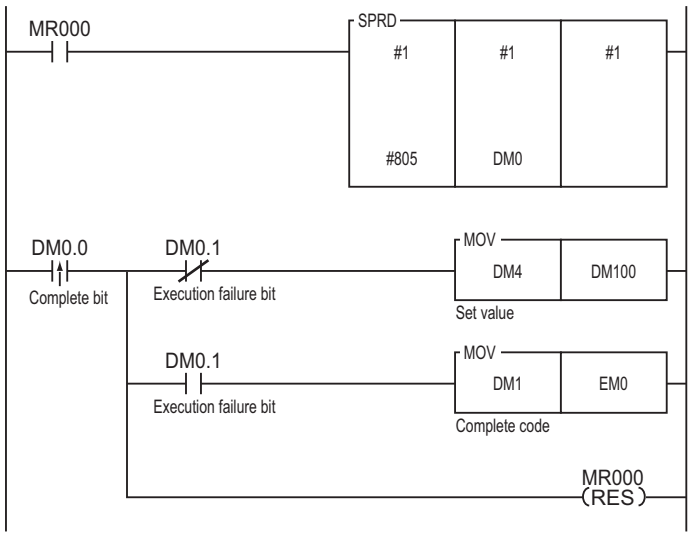
"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

Sample Program

The following makes a description by taking an example of reading current value (parameter No. 805) of light reception of FS-N10 Series connected to EtherNet/IP communication unit NU-EP1 from KEYENCE.

When input relay MR000 is ON, the contents of parameter No. 805 (current value of light reception) of sensor (node address 1, slot No. 1) connected to No. 1 unit KV-EP21V is read, and stored in DM0.



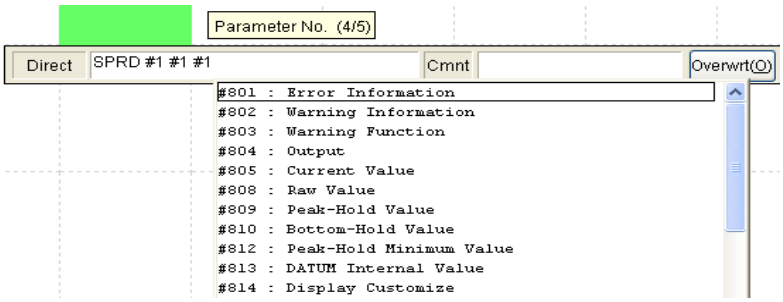
(Mnemonic list)

```
LD MR000
SPRD #1 #1 #1 #805 DM0
LDP DM0.0
MPS
ANB DM0.1
MOV DM4 DM100
MRD
AND DM0.1
MOV DM1 EM0
MPP
RES MR000
```

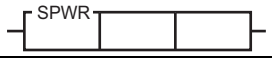
Reference

When inputting SPRD command (read sensor parameter) from KV STUDIO, if RT edit of option setting is used, parameter No. and name will be displayed as alternate in direct input, it can be selected from menu easily.

SPRD input from KV STUDIO



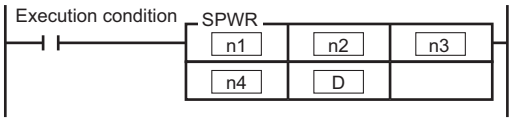
SPWR



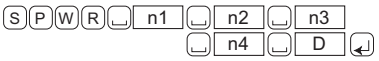
Write sensor parameter

Write the parameter of specified sensor.

Ladder program



Input methods



Operand	Available device																		Index modification
	Bit device							Word device							Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
n2	○	-	○	-	-	-	○	○	○*4	○	○	○	○	○	○	○	-	○	○	○
n3	○	-	○	-	-	-	○	○	○*4	○	○	○	○	○	○	○	-	○	○	○
n4	○	-	○	-	-	-	○	○	○*4	○	○	○	○	○	○	○	-	○	○	○
D	○	-	○	-	-	-	○	○	○*4	-	-	-	-	-	○	-	-	○	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
n2	Specify node address (1 to 256) or its storage device. *1
n3	Specify slot No. or its storage device. In case of other than rack configuration unit or specifying communication adapter, specify 0. *1
n4	Specify parameter No. or its storage device. *1
D	Specify the leading device No. to store complete code or parameter write result. *2*3

*1 If bit device is specified, consecutive 16 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

*2 If bit device is specified, please specify the leading device of the channel.

*3 The number of used words (more than 4 words) changes depending on the parameter to be specified.

*4 EM, FM and ZF cannot be used with the KV Nano Series.

Point

KV-5500, KV-EP21V and KV-NC1EP can be used.

Operation Description

SPWR

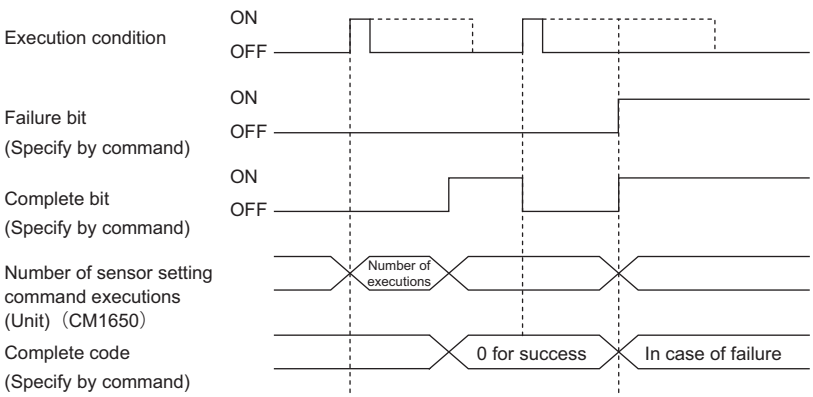
If execution condition is ON, write the set value specified by devices starting from of D + 4 to the parameters specified by sensor n4 (node address n2, slot No. n3) which is connected to No. n1 unit, and upon completion, do storage as follows: bit 0 of D is complete bit, bit 1 of D is execution failure bit, store complete code in D + 1, and store detailed complete code in D + 2.

D to : Result storage location device

Result storage location device			Description
D	Bit 0	Complete bit	It is OFF when starting to execute command, and it is ON when parameter write is completed. Whether the command is completed normally or not, it is always ON.
	Bit 1	Execution failure bit	If command execution is failed, both it and complete bit are ON. It is OFF when starting to execute command.
	Bit 2 to 15	Reserved for system	OFF (fixed value)
D +1	Complete code		Upon completion of parameter writing, store complete code. (Normally 0) "List of the Complete Codes of the Sensor Application Functions", page 7-96
D +2	Detailed complete code		Upon completion of parameter writing, store detailed code.
D +3	Reserved for system		0 (Fixed value)
D +4 to	Write value		Store write value. Based on different parameters have been written, the number of occupied data will be changed.

Point

If the sensor reserved as EtherNet/IP Device is specified, execution is failed.

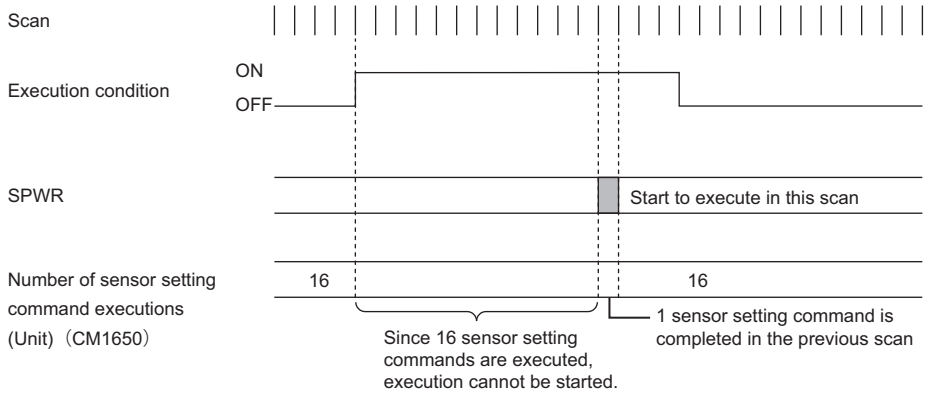


If sensor parameter write command is executed at the rising edge of execution condition, it will continue to process even the input condition is OFF for next scan.

The complete bit and failure bit of result storage device are ON when command is completed, and are OFF when starting to execute command.

Number of sensor setting command executions adds 1 when a command is executed, and subtracts 1 when execution is completed.

When 16 sensor setting commands are executed, even execution condition is set to ON, senor setting command can not be executed. When number of sensor setting commands executed is less than 16, the next senor setting command can be executed.



Operation flag

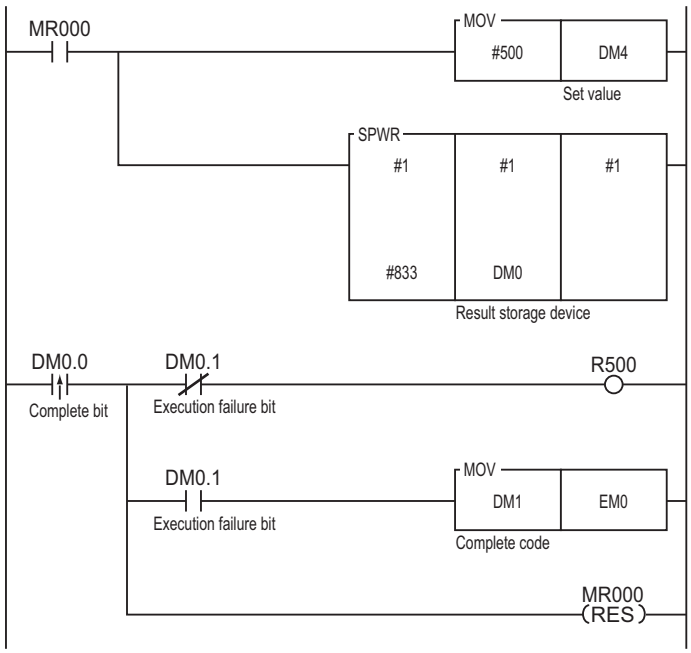
CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON if any of the following conditions is met, otherwise it is OFF. • The unit with the unit No. specified with n1 is not KV-EP21V, KV-5500 or KV-NC1EP. • From the device specified by D, 4-word device cannot be guaranteed. • If bit device is specified for D, device other than the leading device of the channel is specified. • The range of indirect specifying and index modification are inappropriate.

* If CR2012 is ON, command is not executed.
KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.
"KV-5500/5000/3000 User's Manual"
"KV Nano Series User's Manual"

Sample Program

The following make a description by taking an example of changing the set value (parameter No. 833) of FS-N10 Series connected to EtherNet/IP communication unit NU-EP1 from KEYENCE.

When input relay MR0 is ON, the set value 500 specified by devices starting from DM4 is written to parameter No. 833 (set value) of sensor (node address 1, slot No. 1) connected to No. 1 unit KV-EP21V, and the result is stored in devices starting from DM0.



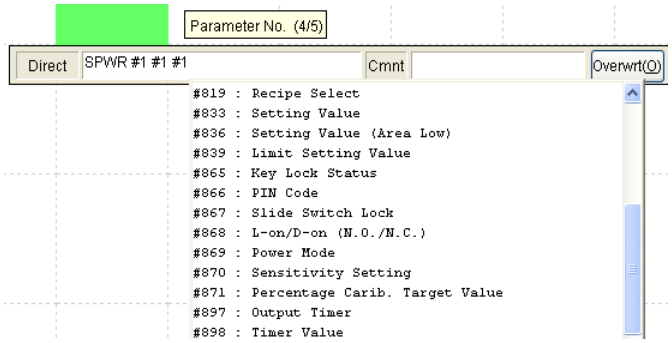
(Mnemonic list)

```
LD MR000
MOV #500 DM4
SPWR #1 #1 #1 #833 DM0
LDP DM0.0
MPS
ANB DM0.1
OUT R500
MRD
AND DM0.1
MOV DM1 EM0
MPP
RES MR000
```

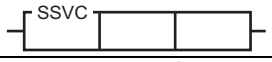
Reference

When inputting SPWR command (write sensor parameter) from KV STUDIO, if RT edit of option setting is used, parameter No. and name will be displayed as alternate in direct input, it can be selected from menu easily.

SPWR input from KV STUDIO



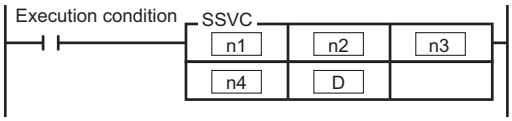
SSVC



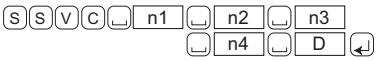
Execute sensor service

Execute the service of specified sensor.

Ladder program



Input method



Operand	Available device																		Index Modification
	Bit device							Word device								Constant	Indirect specifying		Local Bit device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
n2	○	-	○	-	-	-	○	○	○*4	○	○	○	○	○	○	○	-	○	○	○
n3	○	-	○	-	-	-	○	○	○*4	○	○	○	○	○	○	○	-	○	○	○
n4	○	-	○	-	-	-	○	○	○*4	○	○	○	○	○	○	○	-	○	○	○
D	○	-	○	-	-	-	○	○	○*4	-	-	-	-	-	○	-	-	○	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
n2	Specify node address (1 to 256) or its storage device. *1
n3	Specify slot No. or its storage device. In case of other than rack configuration unit or specifying communication adapter, specify 0. *1
n4	Specify service No. or its storage device. *1
D	Specify the leading device No. to store complete code or send data. *2*3

*1 If bit device is specified, consecutive 16 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

*2 If bit device is specified, please specify the leading device of the channel.

*3 Up to 6 words can be used depending on the service to be specified.

*4 EM, FM and ZF cannot be used with the KV Nano Series.

Point

KV-5500, KV-EP21V and KV-NC1EP can be used.

Operation Description

SSVC

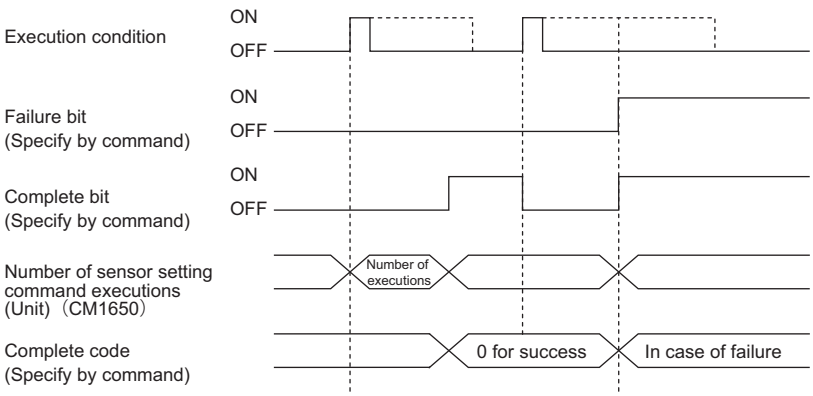
If execution condition is ON, execute the service specified by sensor n4 (node address n2, slot No. n3) which is connected to No. n1 unit, and upon completion, do storage as follows: bit 0 of D is complete bit, bit 1 of D is execution failure bit, store complete code in D + 1, and store detailed complete code in D + 2.

D to : Result storage location device

Result storage location device			Description
D	Bit 0	complete bit	It is OFF when starting to execute command, and it is ON when parameter read is completed. Whether the command is completed normally or not, it is always ON.
	Bit 1	Execution failure bit	If command execution is failed, both it and complete bit are ON. It is OFF when starting to execute command.
	Bit 2 to 15	Reserved for system	OFF (fixed value)
D +1	Complete code		When service execution is completed, store the complete code. (Normally 0) "List of the Complete Codes of the Sensor Application Functions", page 7-96
D +2	Detailed complete code		When service execution is completed, store the detailed complete code.
D +3	Reserved for system		0 (Fixed value)
D +4 D +5	Send data		According service to be executed, specify send data (maximum 2 words).

Point

If the sensor reserved as EtherNet/IP Device is specified, execution is failed.

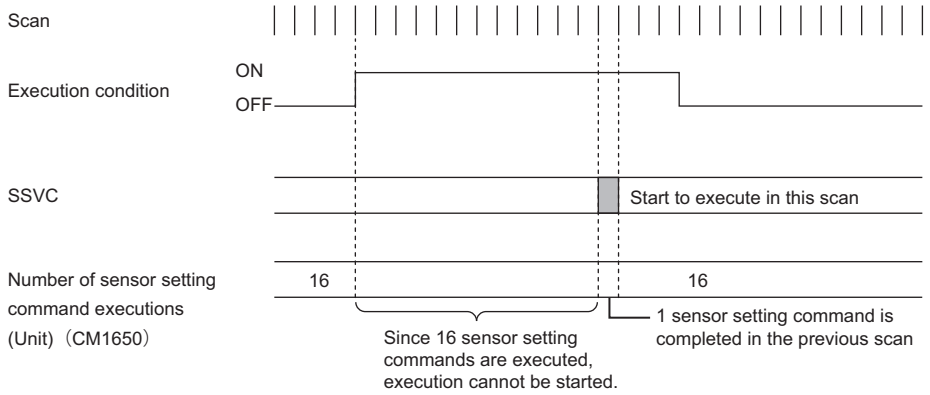


If sensor service execution command is executed at rising edge of execution condition, it will continue to process even the input condition is OFF for next scan.

Number of sensor setting command executions adds 1 when a command is executed, and subtracts 1 when execution is completed.

The complete bit and failure bit of result storage device are ON when command is completed, and are OFF when starting to execute command.

When 16 sensor setting commands are executed, even execution condition is set to ON, senor setting command can not be executed. When number of sensor setting commands executed is less than 16, the next senor setting command can be executed.



Operation flag

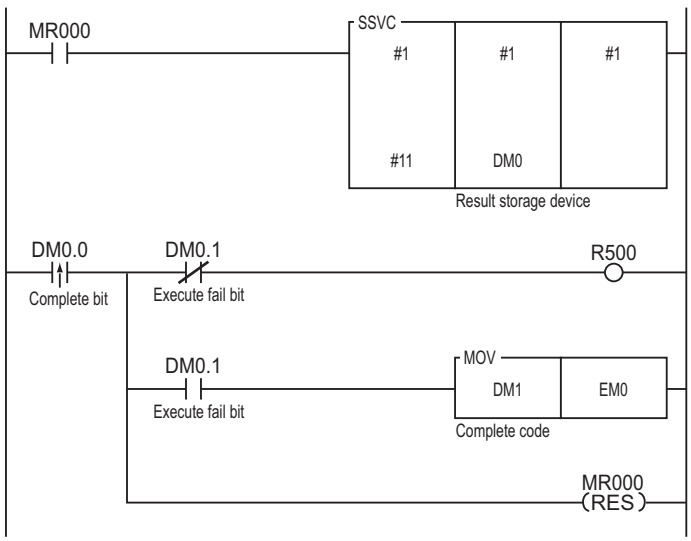
CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON if any of the following conditions is met, otherwise it is OFF. • The unit with the unit No. specified with n1 is not KV-EP21V, KV-5500 or KV-NC1EP. • From the device specified by D, 4-word device cannot be guaranteed. • If bit device is specified for D, device other than the leading device of the channel is specified. • The range of indirect specifying and index modification are inappropriate.

* If CR2012 is ON, command is not executed.
KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.
"KV-5500/5000/3000 User's Manual"
"KV Nano Series User's Manual"

Sample Program

The following make a description by taking an example of using zero shift execution (service No. 11) service of FS-N10 Series connected to EtherNet/IP communication unit NU-EP1 from KEYENCE.

When input relay MR0 is ON, the service of service No. 11 (zero shift execution) of sensor (node address 1, slot No. 1) connected to No. 1 unit KV-EP21V is executed, the result is stored in devices starting from DM0.



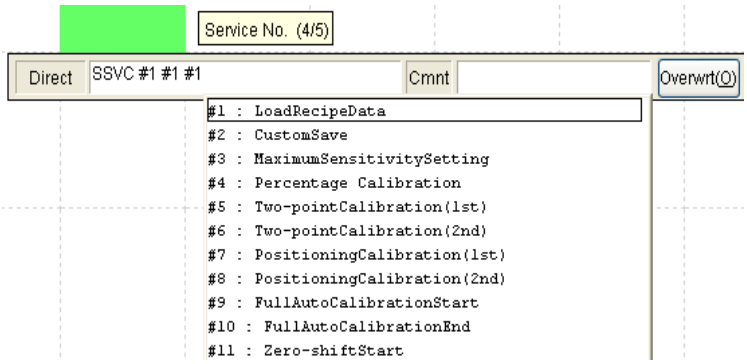
(Mnemonic list)

```
LD MR000
SSVC #1 #1 #1 #11 DM0
LDP DM0.0
MPS
ANB DM0.1
OUT R500
MRD
AND DM0.1
MOV DM1 EM0
MPP
RES MR000
```

Reference

When inputting SSVC command (sensor service execution) from KV STUDIO, if RT edit of option setting is used, parameter No. and name will be displayed as alternate in direct input, it can be selected from menu easily.

SSVC input from KV STUDIO



Sensor Setting Function List

■ Sensor setting function list

Function	Function	Operation	Page
Read sensor parameter	SPRD	Read the parameter of specified sensor.	7-90
Write sensor parameter	SPWR	Write the parameter of specified sensor.	7-92
Execute sensor service	SSVC	Execute service of sensor.	7-94

MEMO

SPRD Read sensor parameter

SPRD (execution condition, unit No., node address, slot No., parameter No., complete code)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
S	Execution condition	Specify bit device used for execution condition.	-	-	-	-	-	-	.B	-	-	○	
n1	Unit No. *1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	-
n2	Node address *3	Specify node address (1 to 256) or its storage device.	.U	.U	.U	.U	-	-	-	-	○	○	-
n3	Slot No. *3	Specify slot No. or its storage device.	.U	.U	.U	.U	-	-	-	-	○	○	-
n4	Parameter No. *3	Specify parameter No. or its storage device.	.U	.U	.U	.U	-	-	-	-	○	○	-
D	Complete code *2*4*5	Specify the leading device No. to store complete code or parameter read result.	.U	.U	.U	.U	.F	.DF	.B	.T	-	○	-
R	Return value	None	-	-	-	-	-	-	-		-	-	-

*1 $ (specify hex) can not be used.

*2 It cannot be specified for CTC, CTH and Z.

*3 If bit device is specified, consecutive 16 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

*4 If bit device is specified, please specify the leading device of the channel.

*5 The number of stored words (more than 4 words) changes depending on execution result.

Point

KV-5500, KV-EP21V and KV-NC1EP can be used.

Operation Description

If the execution condition specified by [S] is ON, read the parameters specified by sensor [n4] (node address [n2], slot No. [n3]) which is connected to No. [n1] unit, and upon completion, do storage as follows: bit 0 of [D] is complete bit, bit 1 of [D] is execution failure bit, store complete code in [D] + 1, store detailed complete code in [D] + 2, store number of array elements (store 1 in case of not array) in [D] + 3, and store details of read parameters in devices starting from [D] + 4.

D to : Result storage location device

Result storage location device			Description
D	Bit 0	Complete bit	It is OFF when starting to execute command, and it is ON when parameter read is completed. Whether the command is completed normally or not, it is always ON.
	Bit 1	Execution failure bit	If command execution is failed, both it and complete bit are ON. It is OFF when starting to execute command.
	Bit 2 to 15	Reserved for system	OFF (fixed value)
D +1	Complete code		Upon completion of parameter reading, store complete code. (Normally 0) "List of the Complete Codes of the Sensor Application Functions", page 7-96
D +2	Detailed complete code		Upon completion of parameter reading, store detailed complete code.
D +3	Number of array elements		Store number of array elements of parameters read. If there is no array, store as 1; if command is completed abnormally, store as 0.
D +4 to	Read result		Store value of parameters. Based on different parameters have been read, the number of occupied data will be changed.

Point

If the sensor reserved as EtherNet/IP Device is specified, execution is failed.

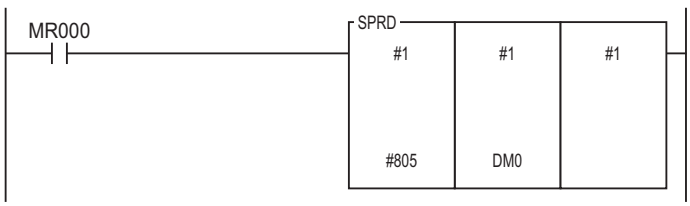
If sensor parameter read command is executed at the rising edge of execution condition, it will continue to process even the input condition is OFF for next scan.
The complete bit and failure bit of result storage device are ON when command is completed, and are OFF when starting to execute command.
Number of sensor setting command executions adds 1 when a command is executed, and subtracts 1 when execution is completed.
please refer to "SPRD Command (Sensor Parameter Read)" for detailed information(page 7-76).

● Format example

Script SPRD(MR0,1,1,1,805,DM0)

Operation If MROO is ON, read the contents of parameter No. 805 of a sensor (node address 1, slot No. 1) connected to No.1 unit, and store it in devices starting from DM0.

Ladder



SPWR Write sensor parameter

SPWR (execution condition, unit No., node address, slot No., parameter No., complete code)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
S	Execution condition	Specify bit device used for execution condition.	-	-	-	-	-	-	.B	-	-	○	
n1	Unit No. *1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	-
n2	Node address *3	Specify node address (1 to 256) or its storage device.	.U	.U	.U	.U	-	-	-	-	○	○	-
n3	Slot No. *3	Specify slot No. or its storage device.	.U	.U	.U	.U	-	-	-	-	○	○	-
n4	Parameter No. *3	Specify parameter No. or its storage device.	.U	.U	.U	.U	-	-	-	-	○	○	-
D	Complete code *2*4*5	Specify the leading device No. to store complete code or parameter write result.	.U	.U	.U	.U	.F	.DF	.B	.T	-	○	-
R	Return value	None	-	-	-	-	-	-	-		-	-	-

*1 $ (specify hex) can not be used.

*2 It cannot be specified for CTC, CTH and Z.

*3 If bit device is specified, consecutive 16 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

*4 If bit device is specified, please specify the leading device of the channel.

*5 The number of stored words (more than 4 words) changes depending on execution result.

Point

KV-5500, KV-EP21V and KV-NC1EP can be used.

Operation Description

If the execution condition specified by S is ON, write the set value specified by devices starting from D + 4 to the parameters specified by sensor n4 (node address n2, slot No. n3) which is connected to No. n1 unit, and upon completion, do storage as follows: bit 0 of D is complete bit, bit 1 of D is execution failure bit, store complete code in D + 1, and store detailed complete code in D + 2.

D to : Result storage location device

Result storage location device			Description
D	Bit 0	complete bit	It is OFF when starting to execute command, and it is ON when parameter write is completed. Whether the command is completed normally or not, it is always ON.
	Bit 1	Execution failure bit	If command execution is failed, both it and complete bit are ON. It is OFF when starting to execute command.
	Bit 2 to 15	Reserved for system	OFF (fixed value)
D +1	Complete code		Upon completion of parameter writing, store complete code. (Normally 0) "List of the Complete Codes of the Sensor Application Functions", page 7-96
D +2	Detailed complete code		Upon completion of parameter writing, store detailed code.
D +3	Reserved for system		0 (Fixed value)
D +4 to	Write value		Store write value. Based on different parameters have been written, the number of occupied data will be changed.

Point

If the sensor reserved as EtherNet/IP Device is specified, execution is failed.

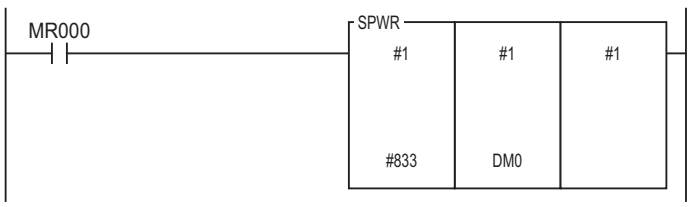
If sensor parameter write command is executed at the rising edge of execution condition, it will continue to process even the input condition is OFF for next scan.
The complete bit and failure bit of result storage device are ON when command is completed, and are OFF when starting to execute command.
Number of sensor setting command executions adds 1 when a command is executed, and subtracts 1 when execution is completed.
please refer to "SPRD Command (Sensor Parameter Write)" for detailed information(page 7-80).

● Format example

Script SPWR(MR0,1,1,1,833,DM0)

Operation If MR000 is ON, write the set value specified by devices starting from DM4 to parameter No. 833 (set value) of sensor (node address 1, slot No. 1) connected to No. 1 unit EtherNet/IP Unit, and store the results in devices starting from DM0.

Ladder



SSVC Execute sensor service

SSVC (execution condition, unit No., node address, slot No., parameter No., complete code)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
S	Execution condition	Specify bit device used for execution condition.	-	-	-	-	-	-	.B	-	-	○	
n1	Unit No. *1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	-
n2	Node address *3	Specify node address (1 to 256) or its storage device.	.U	.U	.U	.U	-	-	-	-	○	○	-
n3	Slot No. *3	Specify slot No. or its storage device.	.U	.U	.U	.U	-	-	-	-	○	○	-
n4	Parameter No. *3	Specify parameter No. or its storage device.	.U	.U	.U	.U	-	-	-	-	○	○	-
D	Complete code *2*4*5	Specify the leading device No. to store complete code or parameter read result.	.U	.U	.U	.U	.F	.DF	.B	.T	-	○	-
R	Return value	No	-	-	-	-	-	-	-		-	-	-

*1 $ (specify hex) can not be used.

*2 It cannot be specified for CTC, CTH and Z.

*3 If bit device is specified, consecutive 16 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

*4 If bit device is specified, please specify the leading device of the channel.

*5 Up to 6 words can be used depending on the service to be specified.

Point

KV-5500, KV-EP21V and KV-NC1EP can be used.

Operation Description

If the execution condition specified by S is ON, execute the service specified by sensor n4 (node address n2, slot No. n3) which is connected to No. n1 unit, and upon completion, do storage as follows: bit 0 of D is complete bit, bit 1 of D is execution failure bit, store complete code in D + 1, and store detailed complete code in D + 2.

D to : Result storage device

Result storage location device			Description
D	Bit 0	Complete bit	It is OFF when starting to execute command, and it is ON when parameter read is completed. Whether the command is completed normally or not, it is always ON.
	Bit 1	Execution failure bit	If command execution is failed, both it and complete bit are ON. It is OFF when starting to execute command.
	Bit 2 to 15	Reserved for system	OFF (fixed value)
D +1	Complete code		When service execution is completed, store the complete code. (Normally 0) "List of the Complete Codes of the Sensor Application Functions", page 7-96
D +2	Detailed complete code		When service execution is completed, store the detailed complete code.
D +3	Reserved for system		0 (Fixed value)
D +4 D +5	Send data		According service to be executed, specify send data (maximum 2 words).

Point

If the sensor reserved as EtherNet/IP Device is specified, execution is failed.

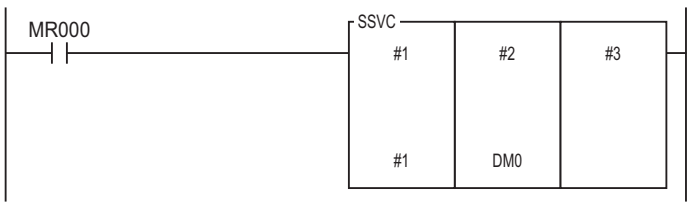
If sensor service execution command is executed at rising edge of execution condition, it will continue to process even the input condition is OFF for next scan.
The complete bit and failure bit of result storage device are ON when command is completed, and are OFF when starting to execute command.
Number of sensor setting command executions adds 1 when a command is executed, and subtracts 1 when execution is completed.
please refer to "SSVC command (Sensor Service Execution)" for detailed information (page 7-84).

● Format example

Script SSVC(MR0,1,2,3,1,DM0)

Operation If MR000 is ON, execute the service of service No. 1 of sensor (node address 1, slot No. 1) connected to No. 1 unit EtherNet/IP Unit, and store results in devices starting from DM0.

Ladder



7-8 Complete Code

This section describes complete codes and detailed complete codes when executing backup sensor settings function, batch transmission sensor settings function, and sensor setting command from program in list.

List of the Complete Codes of the Sensor Application Functions

Reference If problems can not be solved based on causes and measures, or check method is unclear, see the troubleshooting No. description. "Troubleshooting", page A-16

Complete code (decimal)	Detailed complete code (decimal)	Description	Cause and measures	Cause of error	Troubleshooting No.
0	0	OK			
3	-	Error of incorrect parameter value	The specified parameter value is incorrect. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Parameter	101
5	-	Slot/parameter non-existent error	Specified slot or parameter is non-existent, thus can not be executed. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Parameter	100
8	-	Error with service unsupported	Target unit does not support specified services. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Parameter	100
9	-	Error with beyond write value range	Parameter can not be written due to write value is beyond the range. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Parameter	101
11	-	Error with mode/ status do not change	Target unit is in the specified mode, can not be written. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Parameter	101
12	-	Error with unit status	Target unit is under the condition that processing cannot be executed, can not be executed. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Parameter	100
14	-	Error with written to read special parameter	Write can not be completed due to write execution to parameter can not be written. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Parameter	100
16	-	Error with unit status	Target unit is under the condition that processing cannot be executed, can not be executed. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Parameter	100
22	-	Slot/parameter non-existent error	Specified slot or parameter is non-existent, thus can not be executed. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Parameter	100

Complete code (decimal)	Detailed complete code (decimal)	Description	Cause and measures	Cause of error	Troubleshooting No.
25	-	Error with parameter save failure	Written parameter data can not be saved due to error occurred during saving. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Parameter	100
31	-	vendor intrinsic error	Target unit intrinsic error occurred. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Parameter	100
32	-	Error with parameter value invalid	Written value is invalid, can not be executed. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting. • Please check written parameter value is accurate or not.	Parameter	101
33	-	Multiple written errors	Execute write to unchangeable value, thus can not be written. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Parameter	100
208 to 255	-	Adapter unit intrinsic error	The intrinsic error of adapter unit. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Parameter	100
10500	0	Error with explicit messages time out	Time out error occurred during explicit messages. • Please check the power supply or cable status of units at communication path of target unit or switch etc. • Please check Ethernet link status to be 100Mbps, full duplex link via unit monitor. • Please check whether the network has load or not.	Node	102
10501	0	Process execution interruption error	Processing interrupted due to Ladder program transfer or one of the Reset services.	Function	103
10502	0	Process execution interruption error	Processing interrupted since Ladder program transfer or Reset service is executed.	Function	103
10503	0	Error with inconsistent read and write attribute	Execute write operation on parameter can not be written, or execute read operation on parameter specially used for write. • Please check whether the execution processing request is accurate or not according to read and write attribute of the parameter.	Parameter	104
10504	0	Incorrect node address error	The specified node address can not be used in executed function. • Please check whether the specified node address is available or not in EtherNet/IP setting.	Node	105

Complete code (decimal)	Detailed complete code (decimal)	Description	Cause and measures	Cause of error	Troubleshooting No.
10505	0	Error with slot No. incorrect	The specified slot No. can not be used in functions to be executed. • Please check whether the specified slot No. is available or not in EtherNet/IP Setting.	Sensor	105
10506	1	Error with compatibility check	Vendor ID of the unit specified by node address and slot No. is inconsistent with target unit • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Sensor	106
10506	2	Error with compatibility check	Device type of the unit specified by node address and slot No. is inconsistent with target unit. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Sensor	106
10506	3	Error with compatibility check	Serial code of the unit specified by node address and slot No. is inconsistent with target unit. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Sensor	106
10506	4	Error with compatibility check	Serial version of the unit specified by node address and slot No. is inconsistent with target unit. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Sensor	106
10506	5	Error with compatibility check	Product code of the unit specified by node address and slot No. is inconsistent with target unit. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Sensor	106
10506	6	Error with compatibility check	Major revision of the unit specified by node address and slot No. is inconsistent with target unit. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Sensor	106
10506	7	Error with compatibility check	Number of occupied slots of the unit specified by node address and slot No. is inconsistent with target unit. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Sensor	106

Complete code (decimal)	Detailed complete code (decimal)	Description	Cause and measures	Cause of error	Troubleshooting No.
10506	101	Error with compatibility check	Vendor ID of the unit specified by node address and slot No. is inconsistent with value in backup file. • Please check whether the specified backup data include information of unit which has compatibility with the unit set by EtherNet/IP Setting.	Sensor	106
10506	102	Error with compatibility check	Device type of the unit specified by node address and slot No. is inconsistent with value in backup file. • Please check whether the specified backup data include information of unit which has compatibility with the unit set by EtherNet/IP Setting.	Sensor	106
10506	103	Error with compatibility check	Serial code of the unit specified by node address and slot No. is inconsistent with value in backup file. • Please check whether the specified backup data include information of unit which has compatibility with the unit set by EtherNet/IP Setting.	Sensor	106
10506	104	Error with compatibility check	Serial version of the unit specified by node address and slot No. is inconsistent with value in backup file. • Please check whether the specified backup data include information of unit which has compatibility with the unit set by EtherNet/IP Setting.	Sensor	106
10506	105	Error with compatibility check	Product code of the unit specified by node address and slot No. is inconsistent with value in backup file. • Please check whether the specified backup data include information of unit which has compatibility with the unit set by EtherNet/IP Setting.	Sensor	106
10506	106	Error with compatibility check	Major revision of the unit specified by node address and slot No. is inconsistent with value in backup file. • Please check whether the specified backup data include information of unit which has compatibility with the unit set by EtherNet/IP Setting.	Sensor	106
10506	107	Error with compatibility check	Number of occupied slots of the unit specified by node address and slot No. is inconsistent with value in backup file. • Please check whether the specified backup data include information of unit which has compatibility with the unit set by EtherNet/IP Setting.	Sensor	106
10507	0	Unset IP address error	Failed to execute the request because IP address is not set • Please set IP address.	Function	129
10513	0	Error in Ethernet setting	Failed to execute because error occurred during Ethernet setting of EtherNet/IP Device.	Function	108

Complete code (decimal)	Detailed complete code (decimal)	Description	Cause and measures	Cause of error	Troubleshooting No.
10515	0	Data size error with compatibility check	Compatibility check is executed between units specified by node address/slot No., but capturing data for check is failed. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Sensor	106
10516	0	No object sensor/ parameter error	Object sensor/parameter does not exist. • Please change EtherNet/IP Setting and make the number of sensors/parameters serving as execution object is more than 1.	Function	110
10517	0	Error with process execution failure	Failed to execute process because unit setting information is changed or the Reset service is executed.	-	103
10518	0	Error with process execution failure	Failed to execute process because unit setting information is changed or the Reset service is executed.	-	103
10521	0	Error with incorrect data size	Failed to execute request due to incorrect data size read • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Parameter	100
10600	0	Error with no backup file	Restore sensor settings is aborted due to inexistent of file specified. • Please specify correct backup sensor settings file No. in memory card.	Function	111
10601	0	Error with abnormal file format	Restore is unavailable due to abnormal content in backup sensor settings file specified. • Please specify other backup sensor settings file No..	Function	112
10602	0	Error with insufficient free space	Backup sensor settings is aborted due to insufficient free space of memory card. • Please ensure sufficient free space and then execute it again.	Function	113
10603	0	Error with no memory card	Backup sensor settings is not executed due to no memory card in CPU unit. • Please install memory card in CPU unit.	Function	114
10604	0	Other error with memory card	Error occurred during access of memory card based on backup sensor settings file. • Please execute it again.	Function	115
10605	0	Interrupt error based on interrupt request	Backup sensor settings is aborted due to backup sensor settings interrupt request relay or cancel button operation of VT screen.	Function	116
10606	0	Error with execution request in process	Failed to execute process, because the backup sensor settings is being executed.	Function	117

Complete code (decimal)	Detailed complete code (decimal)	Description	Cause and measures	Cause of error	Troubleshooting No.
10607	0	Error with file No. duplication	Backup sensor settings is aborted because the specified file No. has been existed or there is no free No.. • Please execute it again after deleting file.	Function	118
10608	0	Error directory creation failure	Failed to create directory for backup • Please check if no duplicate file name found in directory, or failed to execute other functions of memory card.	Function	119
10609	0	Error with backup file version	Failed to restore because data which are unsuitable to target unit in the specified backup file.	Function	120
10611	0	Error with mismatched parameter	Failed to execute process because restore sensor settings is executed on the unit without compatibility. • Please check if the connected unit has compatibility with unit set by EtherNet/IP Setting.	Parameter	121
10612	0	Error with mismatched file contents	Backup sensor settings is aborted because a change occurred in content of the selected backup file. • Please keep the file contents unchanged and then execute it again.	Function	109
10700	0	Error with incorrect setting No.	Failed to execute progress because specified the setting No. is beyond range, or no batch transmission sensor settings with specified setting No.. • Please check settings of the setup batch transmission sensor settings in EtherNet/IP Setting. • Please check if the setting No. is within the range of 0 to 127.	Function	122
10701	0	Interrupt error based on interrupt request	Batch transmission sensor settings processing is interrupted by batch transmission sensor settings interrupt request relay.	Function	116
10702	0	Error with execution request in process	Failed to execute the request because batch transmission sensor settings is being processed. • Please change the program to avoid concurrent request for read/write processing.	Function	123
10800	0	Error with device beyond range	Failed to execute sensor setting command, because the specified device is out of range.	-	124
10801	0	Error with incorrect parameter No.	Failed to execute process because the specified parameter does not exist.	-	125
10802	0	Error with incorrect service No.	Failed to execute process because the specified service does not exist.	-	125
20000 to 20999	0	Communication error occurred when executing compatibility check	Error occurred on communication with target unit when executing compatibility check. Error details are stored in lower 3 digits* of complete code and detailed complete code (CIP detailed status).	Sensor	106

Complete code (decimal)	Detailed complete code (decimal)	Description	Cause and measures	Cause of error	Troubleshooting No.
21000 to 21999	0	Communication error occurred when executing mode change	Error occurred on communication with target unit when executing mode change. Error details are stored in lower 3 digits* of complete code and detailed complete code (CIP detailed status).	Sensor	127
22000 to 22999	0	Communication error occurred when reading mode	Error occurred on communication with target unit when reading mode. Error details are stored in lower 3 digits* of complete code and detailed complete code (CIP detailed status).	Sensor	127
23000 to 23999	0	Communication error occurred when waiting for execution of mode change	Error occurred on communication with target unit when waiting for execution of mode change. Error details are stored in lower 3 digits* of complete code and detailed complete code (CIP detailed status).	Sensor	127
24000 to 24999	0	Communication error occurred when saving in non-volatile storage	Error occurred on communication with target unit when saving non-volatile storage. Error details are stored in lower 3 digits* of complete code and detailed complete code (CIP detailed status).	Sensor	128
25000 to 25999	0	Communication error occurred when waiting for save completion of non-volatile storage	Error occurred on communication with target unit when saving non-volatile storage. Error details are stored in lower 3 digits* of complete code and detailed complete code (CIP detailed status).	Sensor	128
65000	0	Error with communication setting	Failed to execute sensor setting command because communication setting does not exist	-	134

* Please check causes/measures of lower 3 digits of complete code.

Point

The contents of complete code 1 to 255 are general status (stipulated by CIP) returning from sensor (adapter) of communication object. For codes other than complete code list stored, see "CIP General Status List", page 4-153.
Please refer to NO.100 for troubleshooting.

7-9 Appendix

This section describes supplementary information on sensor application function.

Supported Data Type and Storage Mode

The following describes data type of parameter supported by sensor application function.

■ Supported data type

The CIP data type supported by sensor application function is described as follows.
Name of supported data type and data code are stated by CIP.

Supported data type (CIP data)	Data size	Data code (H)	Description	Range
BOOL	1 byte	C1	Boolean	0:FALSE(OFF)/1:TRUE(ON)
SINT	1 byte	C2	Signed 8-bit data	-128 to 127
INT	2 bytes	C3	Signed 16-bit data	-32768 to 32767
DINT	4 bytes	C4	Signed 32-bit data	-2147483648 to 2147483647
USINT	1 byte	C6	Unsigned 8-bit data	0 to 255
UINT	2 bytes	C7	Unsigned 16-bit data	0 to 65535
UDINT	4 bytes	C8	Unsigned 32-bit data	0 to 4294967295
REAL	4 bytes	CA	Single floating real number	*1
LREAL	8 bytes	CB	Double floating real number	*2
STRING	-*3	D0	(CIP) character string	-
BYTE	1 byte	D1	Bit array: 8 bits	-
WORD	2 bytes	D2	Bit array: 16 bits	-
DWORD	4 bytes	D3	Bit array: 32 bits	-

*1 For KV-EP21V and KV-5500: -3.4E38<=N<=-1.2E-38, N=0, +1.2E-38<=N<=+3.4E38
For KV-NC1EP: -3.4E38<=N<=-1.4E-45, N=0, +1.4E-45<=N<=+3.4E38

*2 -1.79E+308<=N<=-2.23E-308, N=0, 2.23E-308<=N<=1.79E+308

*3 It varies with the size of character string.

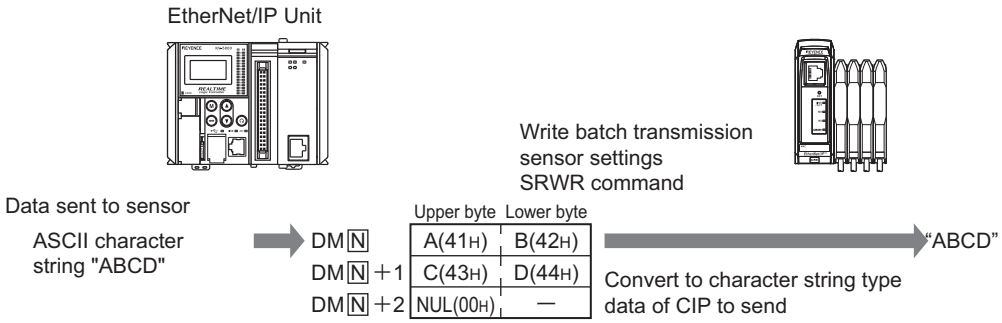
■ CIP character string type data and storage mode

The following describes the device storage mode if the parameter data type is CIP character string (STRING).

No need to consider CIP character string (STRING) if batch transmission sensor settings function or sensor setting command is used.

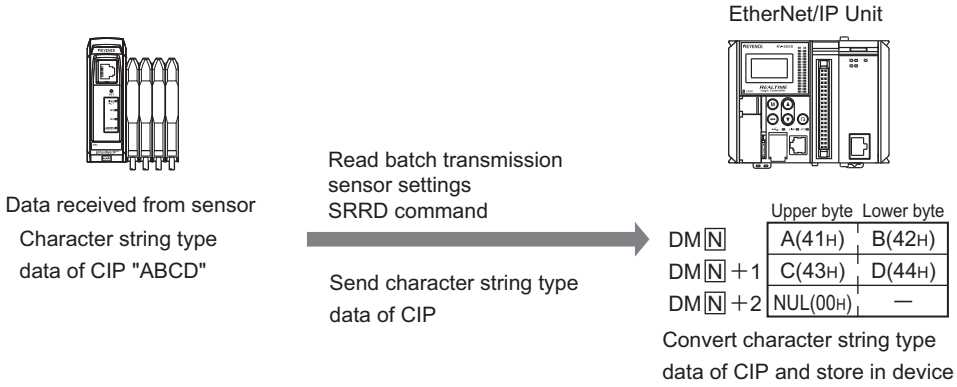
In case of data send (EtherNet/IP Unit->Sensor)

The data stored in device is converted to CIP character string type data, and then send to sensor.



In case of data receive (Sensor->EtherNet/IP Unit)

CIP character string type data received from sensor is stored in device after conversion.



8

HOST-LINK COMMUNICATION FUNCTION

This chapter describes the operating principle, communication settings, command and response of host-link communication.

8-1 Host-link Communication Function 8-2
8-2 Communication Specification 8-3
8-3 Communication Procedure 8-5
8-4 Command List 8-8
8-5 Description of the Commands and Responses 8-9

8-1 Host-link Communication Function

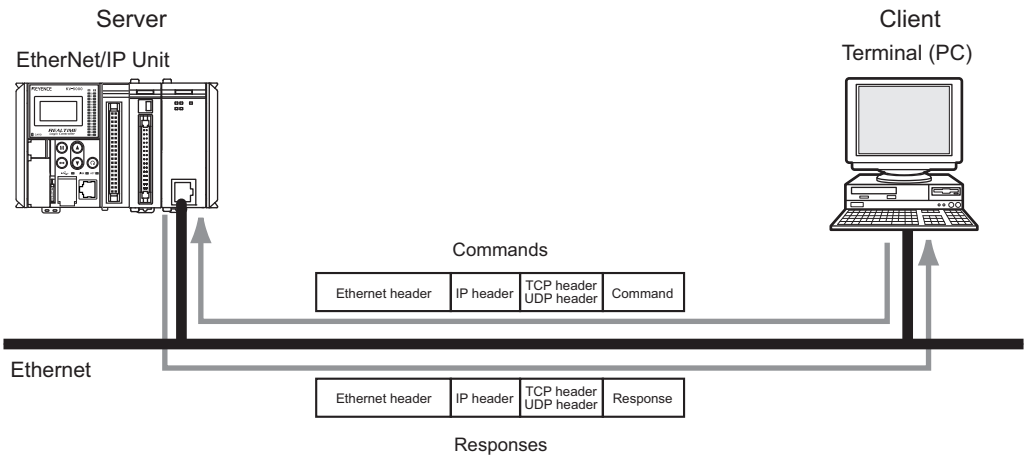
This section gives a general description on host-link communication function.

■ Application

The device values of CPU unit can be read/written by sending commands in preset format from a terminal (such as PC) connected to Ethernet.
The ladder program for communication is not required on CPU unit because a response is automatically returned to commands sent from external units.

■ Communication principle

By creating a communication program on the terminal (PC), data can be read from/written into the CPU unit, and the operation status can be monitored by sending commands to the KV-EP21V via the Ethernet from the terminal (PC), and receiving responses via the Ethernet from the EtherNet/IP Unit.
During communication, PLC equipped with EtherNet/IP Units serve as servers, terminals (such as PCs) serve as clients. The server automatically returns to the client the appropriate responses to commands received from the client.
Host-link communication supports TCP/IP and UDP/IP communication protocols.



8-2 Communication Specification

This section describes the communication specification of the host-link communication function. Setting of EtherNet/IP Unit terminals is executed by the Unit Editor.

Setting Items of Unit Editor

Unit Editor is used for setting up EtherNet/IP Unit communication. Setting items of Unit Editor is as follows. For the setting method, see "3-1 Unit Editor Setting", page 3-2.

Item	Settings	Setting range	Default value	See page
Leading DM No.	Set No. not for any other purpose.	0 to 65304*1	To be set	3-6
Number of DMs in use	Number of DMs used by the unit	230	230	-
Leading relay No. (set up by channel)	Set No. not for any other purpose.	10 to 960*2	To be set	3-6
Number of relays in use	Number of relays used by the unit	640	640	-
Baud rate	Set up according to the network used.	100M/10Mbps Auto/ 10Mbps	100M/10Mbps Auto	3-6
Setting method of IP address	Set up the IP address setting method.	Fixed IP address/ BOOTP->Fixed IP auto switching/BOOTP	Fixed IP address	3-6
IP address	Set up an IP address not duplicated with other nodes.	0.0.0.0 to 255.255.255.255	192.168.0.10	3-7
Subnet mask	Set up an appropriate subnet mask.	0.0.0.0 to 255.255.255.255	255.255.255.0	3-7
Default gateway	Set up an appropriate default gateway.	0.0.0.0 to 255.255.255.255	0.0.0.0	3-7
Port No. (host-link)	Change as required.	1 to 65535	8501	3-8
Receive time out [s]	Set to an appropriate value.	0 to 59	10	3-8
Keep-Alive [s]	Set to an appropriate value.	0 to 65535	600	3-8
Route setting	Set up as required.	Yes/No	No	3-10
Communication counterpart IP address 1 to 6	Set up as required.	0.0.0.0 to 255.255.255.255	0.0.0.0 (unused)	3-10
Communication counterpart subnet mask 1 to 6	Set up as required.	0.0.0.0 to 255.255.255.255	0.0.0.0 (unused)	3-10
Router IP address 1 to 6	Set up as required.	0.0.0.0 to 255.255.255.255	0.0.0.0 (unused)	3-10

*1 0 to 32538 when using KV-NC1EP.

*2 10 to 560 when using KV-NC1EP.

Communication Specification

The communication control of EtherNet/IP Units is based on TCP/IP and UDP/IP. Specification of TCP/IP and UDP/IP communication is as follows.

■ TCP/IP

Item	Description
Communication mode	TCP/IP
Used port No.	8501 (Changeable)
Number of sockets	15 (common for MC protocol communication)
Data code	ASCII code

■ UDP/IP

Item	Description
Communication mode	UDP/IP
Used port No.	8501 (Changeable)
Number of sockets	1
Data code	ASCII code

Devices Used for Host-link Communication

Devices used for host-link communication function are as follows.

Item	Device No.	Read/write
Send times	Leading DM+0 to 1	Read
Receive times	Leading DM+2 to 3	Read
Socket utilization (host-link)	Leading DM+9	Read
EtherNet/IP Unit system error	Leading DM+12	Read
MAC address	Leading DM+13 to 15	Read

Point

0 is stored in the error DM (leading DM + 12) if no error occurs on the EtherNet/IP Unit. In case of error, the corresponding error No. will be stored in this DM. For the setting method, see "A-4 Error List", page A-4.

8-3 Communication Procedure

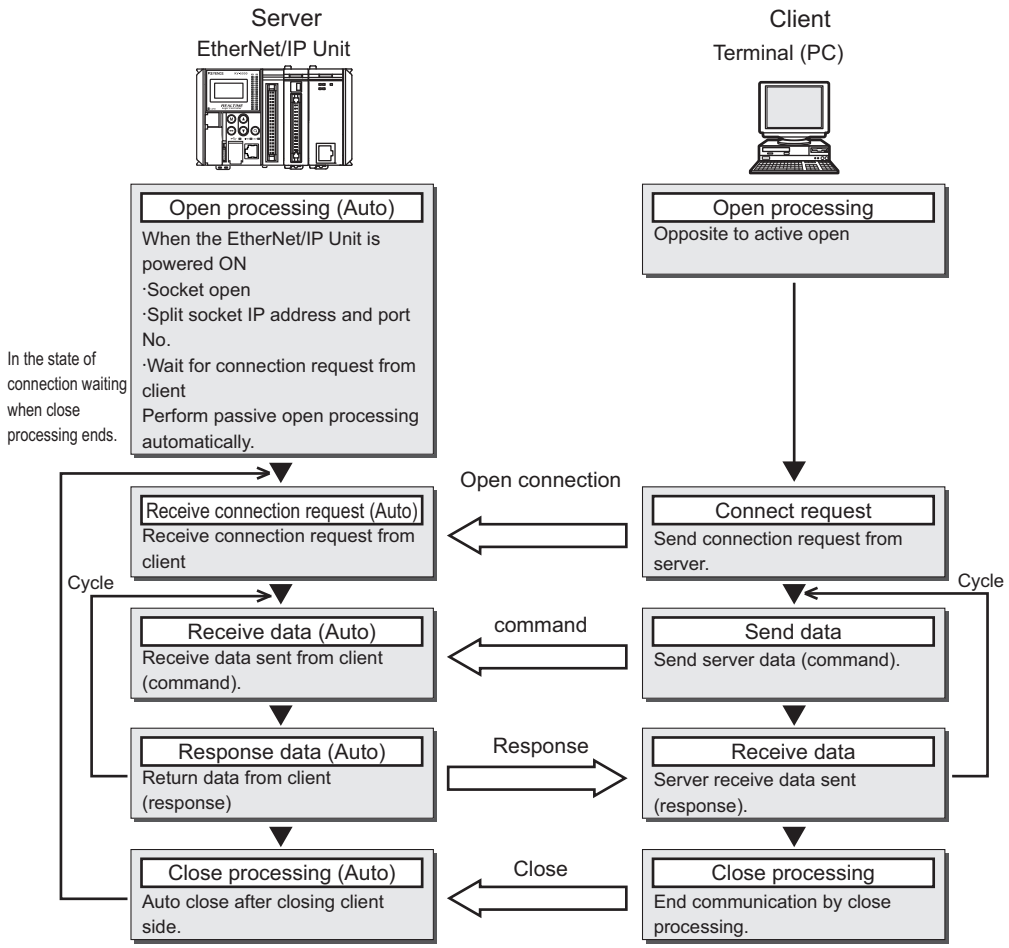
This section describes the principle of communication between EtherNet/IP Units and a terminal (e.g. PC) on the network using the host-link communication function, as well as the format of commands and responses.

Communication Principle

Host-link communication supports TCP/IP and UDP/IP communication protocols.
The following describes the communication principles based on TCP/IP and UDP/IP protocols.

■ Communication principle based on TCP/IP protocol

Communication principle based on TCP/IP protocol is as follows.
During communication, the EtherNet/IP Unit serves as a server, and the communication target terminal (e.g. PC) serves as a client.
The EtherNet/IP Unit automatically responds to the requests from the client.

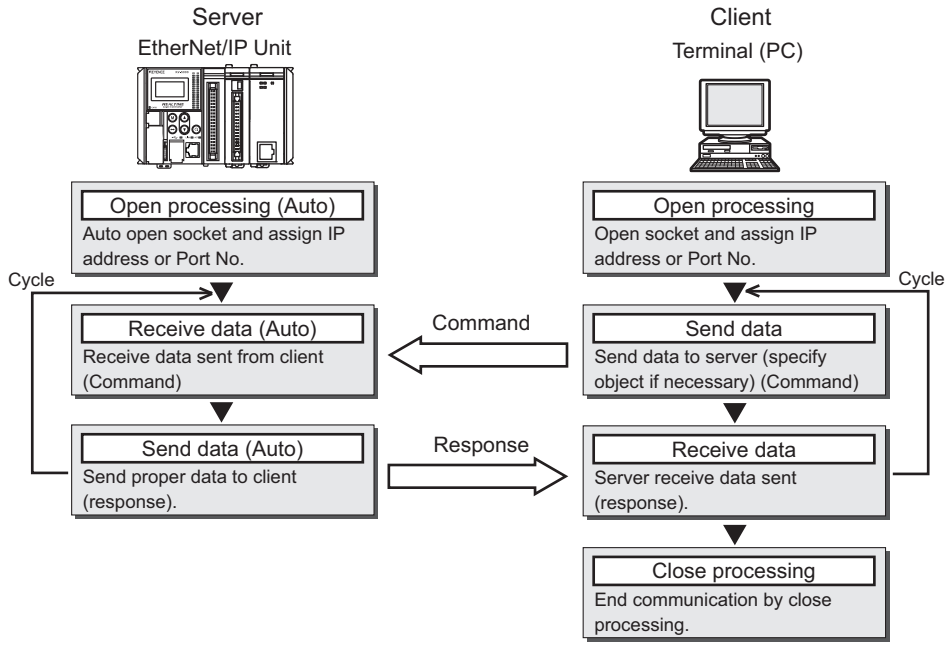


■ Communication principle based on UDP/IP protocol

Communication principle based on UDP/IP protocol is as follows.

During communication, the EtherNet/IP Unit serves as a server, and the communication target terminal (e.g. PC) serves as a client.

The EtherNet/IP Unit automatically responds to the requests from the client.



Command and Response Format

The following describes command and response format of communication data for host-link communication function. The format of command and response is different for TCP/IP and UDP/IP communication.

■ Format for TCP/IP communication

Command format

Send a command from the PC to the EtherNet/IP Unit according to the following format.

$\boxed{C_R}$ (0DH) is separator. The EtherNet/IP Unit ignores $\boxed{L_F}$ (0AH), characters after $\boxed{L_F}$ (0AH) are identified as the next command.

Ethernet header	IP header	TCP header	Command	C_R	
Ethernet header	IP header	TCP header	Command	C_R	L_F

or

Response format

The EtherNet/IP Unit returns a response to a command according to the following format. When PC generates a program, receive processing must be executed according to this response format.

Ethernet header	IP header	TCP header	Response	C_R	L_F

■ Format for UDP/IP communication

Command format

Send a command from the PC to the EtherNet/IP Unit according to the following format.

C_R(0DH) is separator. The EtherNet/IP Unit ignores L_F (0AH), characters after L_F (0AH) are identified as the next command.

Ethernet header	IP header	UDP header	Command	C_R

or

Ethernet header	IP header	UDP header	Command	C_R	L_F

Response format

The EtherNet/IP Unit returns a response to a command according to the following format.

When PC generates a program, receive processing must be executed according to this response format.

Ethernet header	IP header	UDP header	Response	C_R	L_F

8-4 Command List

Host-link communication command list.

Function	Command	See page
Change mode	Mn	8-9
Clear error	ER	8-10
Check error No.	?E	8-10
Query model	?K	8-12
Confirm operating mode	?M	8-12
Time setting	WRT	8-13
Forced set/forced reset	ST/RS	8-14
Continuous forced set/forced reset	STS/RSS	8-15
Data read	RD	8-16
Consecutive data read	RDS	8-16
Consecutive data read	RDE	8-20
Data write	WR	8-21
Write consecutive data	WRS	8-21
Write consecutive data	WRE	8-23
Write set value	WS	8-23
Write consecutive set value	WSS	8-23
Register monitor	MBS/MWS	8-24
Read monitor	MBR/MWR	8-27
Read comments	RDC	8-28
BANK switching	BE	8-29
Read expansion unit buffer memory	URD	8-30
Write expansion unit buffer memory	UWR	8-31

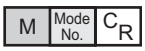
8-5 Description of the Commands and Responses

This section describes various commands and responses and how to set up them.

Mn Change Mode

Switches the CPU unit to PROGRAM mode or RUN mode.

■ Command



Mode No. : If "0" is specified, CPU unit is switched to PROGRAM mode.
If "1" is specified, CPU unit is switched to RUN mode.

■ Response



OK: During normal command processing, code "OK" is prompted.

■ Error response



E1 : Instruction error



E2 : Program not registered



E5 : PLC error

" Response in case of exception", page 8-32

ER Clear Error

Removes the error in CPU unit.

■ Command

E	R	C_R
45H	52H	0DH

■ Response

O	K	C_R	L_F
4FH	4BH	0DH	0AH

OK: During normal command processing, code "OK" is prompted.

■ Error response

E	1	C_R	L_F
45H	31H	0DH	0AH

E1: Command error

" Response in case of exception", page 8-32

?E Confirm Error No.

Checks the error or exception in CPU unit. For specific error content, please check the error No. list.

■ Command

?	E	C_R
3FH	45H	0DH

■ Response

Error No.	C_R	L_F
	0DH	0AH

Error No. : Error content in CPU; error No. is prompted (no zero suppression).
If no error occurs in CPU, "000" will be displayed.

■ Error response

E	1	C_R	L_F
45H	31H	0DH	0AH

E1: Command error

" Response in case of exception", page 8-32

For error treatment method, see "KV-5500/5000/3000 User's Manual", "KV Nano Series User's Manual".

Error No. List (for KV-5500/5000/3000)

No.	Error content	No.	Error content	No.	Error content
010	CALL nest	054	Unit quantity	121	Stack overflow
011	FOR nest	055	Unit switch	122	System error
012	INT nest	056	Expansion bus communication	123	Device range
013	MPS nest	057	END unit not connected	124	Resource
014	Number of BREAKs	059	Unit version	125	Error buffer memory overflow
015	Convert	080	FLASH ROM exception	126	Error buffer memory exception
019	Object size	081	SRAM exception	127	Auto reading
020	Code size	083	Replace battery	128	Ladder operation
022	Macro nest	084	Clear SRAM	129	Unit error
023	Invalid interrupt	085	RTC voltage drop	130	Direct IO
024	Invalid macro	087	Memory card exception	131	FLASH ROM format
025	Indirect specifying error	088	Memory card removed	132	Ladder file incorrect
026	Invalid address	089	Memory card access in progress OFF	133	KV-BT1 exception
027	Invalid object	090	Wait for memory card to complete	134	Auto loading folder
030	Scan time out of range	091	Ethernet controller exception	135	Memory card is opened
031	Ladder stack overflow	092	Access window exception	136	Memory card is locked
040	No ladder	093	Function expansion unit exception	250	StartUpError Reset
050	Unit checksum	094	Function expansion unit ID		
051	Unit setting information	095	File being accessed	251	AW Timeout Error
052	Unit not connected	118	Invalid transmission data		
053	Expansion bus unit time out	120	Watchdog timer		

Error No. List (for KV Nano Series)

No.	Error content	No.	Error content	No.	Error content
010	CALL nest	082	AW data exception	123	Device range
011	FOR nest	085	Clock data disappearance	125	Error buffer memory overflow
015	Convert	086	RTC exception	127	Auto loading failure
022	Macro nest	092	AW cassette exception	128	Ladder operation
030	Scan time out of range	095	File being accessed	129	Unit error
040	No ladder	096	Extension exception	131	FLASH ROM format
050	Unit checksum	097	Extension switch	132	Ladder file incorrect
051	Unit setting information	098	Extension non responsive	140	AW data OFF when writing
052	Unit not connected	099	Hot swapping	250	AccessWindow E250 Connection Error
053	Expansion bus unit time out	101	Expansion version		
054	Unit quantity	102	POWER OFF error	251	AccessWindow E251 Connection Error
055	Unit switch	103	Power interruption processing excess		
056	Expansion bus communication	104	Consumption current excess		
058	Expansion bus range	105	Power outage hold format		
059	Unit version	106	Reset exception		
060	I/O excess	107	System error		
061	Assigned device duplication	118	Invalid transmission data		
080	FLASH ROM exception	120	Watchdog timer		
081	RAM exception	122	System error		

?K Query Model

Checks PLC model.

■ Command

?	K	C_R
3FH	4BH	0DH

■ Response

Type	C_R	L_F
	0DH	0AH

Type : PLC model is displayed in "Type" in the form of No..

KV-3000	: '51'(35H, 31H)
KV-5000	: '52'(35H, 32H)
KV-5500	: '53'(35H, 33H)
KV-NC32T	: '128'(31H, 32H, 38H)
KV-N60**	: '132'(31H, 33H, 32H)
KV-N40**	: '133'(31H, 33H, 33H)
KV-N24**	: '134'(31H, 33H, 34H)

■ Error response

E	1	C_R	L_F
45H	31H	0DH	0AH

E1: Command error

" Response in case of exception", page 8-32

?M Confirm Operating Mode

Confirms current operating status of CPU unit.

■ Command

?	M	C_R
3FH	4DH	0DH

■ Response

Model	C_R	L_F
	0DH	0AH

Data : Displays current status (mode) of CPU unit with No. It is "0" if CPU unit is in PROGRAM mode or Ladder is not registered, and it is "1" if CPU unit is in RUN mode

■ Error response

E	1	C_R	L_F
45H	31H	0DH	0AH

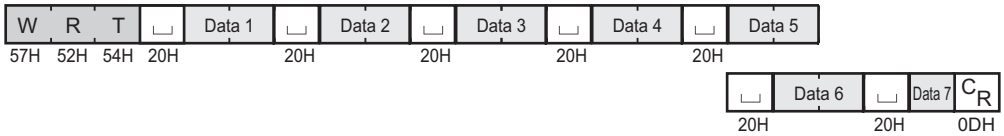
E1: Command error

" Response in case of exception", page 8-32

WRT Time Setting

Sets up time of the CPU unit

■ Command



Data 1 : Enter a two-digit value in Gregorian calendar. 00 means the year of 2000. Data range: 00 to 99.
Data 2 : Enter two-digit month. Data range: 01 to 12.
Data 3 : Enter two-digit day. Data range: 01 to 31.
Data 4 : Enter two-digit hour. Data range: 00 to 23.
Data 5 : Enter two-digit minute. Data range: 00 to 59.
Data 6 : Enter two-digit second. Data range: 00 to 59.
Data 7 : Enter one-digit week. The following table shows the relations between weekday and input value.
Data range: 0 to 6.

input value	0	1	2	3	4	5	6
week	Sun.	Mon.	Tues.	Wed.	Thu.	Fri.	Sat.

■ Response



OK: During normal command processing, code "OK" is prompted.

■ Error response



E1: Command error

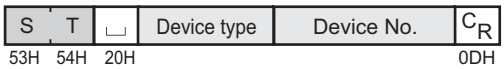
" Response in case of exception", page 8-32

Forced Set "ST"/Forced Reset "RS"

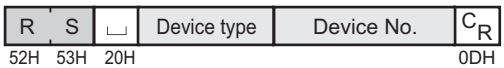
Forcibly sets the contacts of specified device to ON/OFF.

■ Command

<Forced set>



<Forced reset>



Device type		Device No. *1	
Device name		KV-5500/5000/3000	KV Nano
Relay *2	R (can be omitted)	00000 to 99915	00000 to 59915
Link relay	B	0000 to 3FFF	0000 to 1FFF
Internal auxiliary relay *2	MR	00000 to 99915	00000 to 59915
Latch relay *2	LR	00000 to 99915	00000 to 19915
Control relay	CR	0000 to 3915	83915
Timer	T	0000 to 3999	0000 to 511
Counter	C	0000 to 3999	0000 to 255
High-speed counter comparator*3	CTC	0 to 3	0 to 7*4
Work relay	VB	0000 to 3FFF	0000 to 1FFF

*1 Device No. supports zero suppression.

*2 Relays, internal auxiliary relays and latch relays can be expressed with XYM.

" XYM Expression", page 8-33

*3 High-speed counter comparator can be used only for RS command (forced reset).

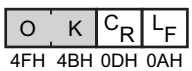
*4 The Device No. which can be used differ according to the base unit.

KV-N14/KV-N24: CTC0 to CTC3

KV-N40/KV-NC32T: CTC0 to CTC5

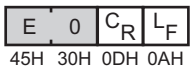
KV-N60: CTC0 to CTC7

■ Response



OK: During normal command processing, code "OK" is prompted.

■ Error response



E0 : Device No. error



E1 : Command error

" Response in case of exception", page 8-32

Continuous Forced Set "STS"/Continuous Forced Reset "RSS"

Forcibly sets the contacts of specified devices to ON/OFF.

■ Command

<Forced set>

S	T	S	␣	Device type	Device No.	␣	Number of written data	C_R
53H	54H	53H	20H			20H		0DH

<Forced reset>

R	S	S	␣	Device type	Device No.	␣	Number of written data	C_R
52H	53H	53H	20H			20H		0DH

Device type		Device No. *1		Number of written devices
Device name		KV-5500/5000/3000	KV Nano	
Relay *2	R (can be omitted)	00000 to 99915	00000 to 59915	01 to 16
Link relay	B	0000 to 3FFF	0000 to 1FFF	01 to 16
Internal auxiliary relay *2	MR	00000 to 99915	00000 to 59915	01 to 16
Latch relay *2	LR	00000 to 99915	00000 to 19915	01 to 16
Control relay	CR	0000 to 3915	0000 to 8915	01 to 16
Work relay	VB	0000 to 3FFF	0000 to 1FFF	01 to 16

*1 Device No. and number of written devices support zero suppression.

*2 Relay, internal auxiliary relay and latch relay can be expressed with XYM.

" XYM Expression", page 8-33

■ Response

O	K	C_R	L_F
4FH	4BH	0DH	0AH

OK: During normal command processing, code "OK" is prompted.

■ Error response

E	0	C_R	L_F
45H	30H	0DH	0AH

E0 : Device No. error

E	1	C_R	L_F
45H	31H	0DH	0AH

E1 : Command error

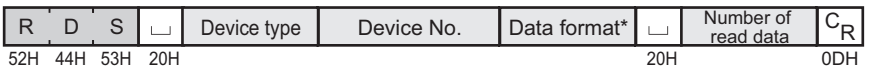
" Response in case of exception", page 8-32

Data Read "RD"/Consecutive Data Read "RDS"

RD: Reads one data of the specified device.
RDS: Reads device data of specified quantity consecutively.

■ Command





* The data format (suffix) of device is specified as .U/.S/.D/.L/.H/(not specified).
.U : Decimal, 16bit, unsigned
.S : Decimal, 16bit, signed
.D : Decimal, 32bit, unsigned
.L : Decimal, 32bit, signed
.H : Hex, 16bit
(Not specified): Depends on device type
" Data simultaneity when the data format is specified as .D/.L", page 8-33

● Devices when using KV-5500 and KV-EP21V

Device type		Device No. *1	Data format not specified	Number of read data	
Device name		KV-5500/5000/3000		Bit /.U/.S/.H	.D/.L
Relay *2	R (can be omitted)	00000 to 99915	(Bit)	0001 to 1000	0001 to 0500
Link relay	B	0000 to 3FFF	(Bit)	0001 to 1000	0001 to 0500
internal auxiliary relay*2	MR	00000 to 99915	(Bit)	0001 to 1000	0001 to 0500
Latch relay *2	LR	00000 to 99915	(Bit)	0001 to 1000	0001 to 0500
Control relay	CR	0000 to 3915	(Bit)	0001 to 1000	0001 to 0500
Work relay	VB	0000 to 3FFF	(Bit)	0001 to 1000	0001 to 0500
Data memory *2	DM	00000 to 65534	.U	0001 to 1000	0001 to 0500
Extended data memory *2	EM	00000 to 65534	.U	0001 to 1000	0001 to 0500
File register *2	FM	00000 to 32767	.U	0001 to 1000	0001 to 0500
	ZF	00000 to 131071	.U	0001 to 1000	0001 to 0500
Link register	W	0000 to 3FFF	.U	0001 to 1000	0001 to 0500
Temporary data memory	TM	000 to 511	.U	001 to 512	001 to 256
Index register	Z	01 to 12	.U	01 to 12	01 to 12
Timer	T	0000 to 3999	.D	001 to 120	001 to 120
Timer (current value)	TC	0000 to 3999	.D	001 to 120	001 to 120
Timer (set value)	TS	0000 to 3999	.D	001 to 120	001 to 120
Counter	C	0000 to 3999	.D	001 to 120	001 to 120
Counter (current value)	CC	0000 to 3999	.D	001 to 120	001 to 120
Counter (set value)	CS	0000 to 3999	.D	001 to 120	001 to 120
High-speed counter	CTH	0 to 1	.D	1 to 2	1 to 2
High-speed counter comparator (set value)	CTC	0 to 3	.D	1 to 4	1 to 4
Digital trimmer	AT	0 to 7	.D	1 to 8	1 to 8
Control memory	CM	0000 to 5999	.U	0001 to 1000	0001 to 0500
Work memory	VM	00000 to 59999	.U	0001 to 1000	0001 to 0500

*1 Device No. and number of read data support zero suppression.

*2 Relays, internal auxiliary relays, latch relays, data memories, extended data memories, and file registers can be expressed with XYM. " XYM Expression", page 8-33

● Devices when using KV-NC1EP

Device type		Device No. *1	Data format not specified	Number of read data *1	
Device name		KV-5500/5000/3000		Bit /.U/.S/.H	.D/.L
Relay*2	R (can be omitted)	00000 to 59915	(Bit)	001 to 256	001 to 128
Link relay	B	0000 to 1FFF	(Bit)	001 to 256	001 to 128
internal auxiliary relay*2	MR	00000 to 59915	(Bit)	001 to 256	001 to 128
Latch relay*2	LR	00000 to 19915	(Bit)	001 to 256	001 to 128
Control relay	CR	0000 to 8915	(Bit)	001 to 256	001 to 128
Work relay	VB	0000 to 1FFF	(Bit)	001 to 256	001 to 128
Data memory*2	DM	00000 to 32767	.U	001 to 256	001 to 128
Link register	W	0000 to 3FFF	.U	001 to 256	001 to 128
Temporary data memory	TM	000 to 511	.U	001 to 256	001 to 128
Index register	Z	01 to 12	.U	01 to 12	01 to 12
Timer	T	000 to 511	.D	01 to 64	01 to 64
Timer (current value)	TC	000 to 511	.D	01 to 64	01 to 64
Timer (set value)	TS	000 to 511	.D	01 to 64	01 to 64
Counter	C	000 to 255	.D	01 to 64	01 to 64
Counter (current value)	CC	000 to 255	.D	01 to 64	01 to 64
Counter (set value)	CS	000 to 255	.D	01 to 64	01 to 64
High-speed counter	CTH	0 to 3*3	.D	1 to 4	1 to 4
High-speed counter comparator (set value)	CTC	0 to 7*3	.D	1 to 8	1 to 8
Control memory	CM	0000 to 8999	.U	001 to 256	001 to 128
Work memory	VM	0000 to 9999	.U	001 to 256	001 to 128

*1 Device No. and number of read data support zero suppression.

*2 Relays, internal auxiliary relays, latch relays, data memories, extended data memories, and file registers can be expressed with XYM. " XYM Expression", page 8-33

*3 The Device No. which can be used differ according to the base unit.
KV-NC32T: CTH0 to CTH2 CTC0 to CTC5
KV-N24: CTH0 to CTH1 CTC0 to CTC3
KV-N40: CTH0 to CTH2 CTC0 to CTC5
KV-N60: CTH0 to CTH3 CTC0 to CTC7

■ Response

<R, B, MR, LR, CR, VB>



* n: Number of read data specified when sending command

Data 1 to n: The values stored in devices in turn from the specified device No..
The data range displayed varies with the data format specified when sending command.

Specified data format		Data 1 to n	
		size	range
Not specified	Bit	1byte	0 (OFF) or 1 (ON)
.U	Decimal, 16bit, unsigned	5byte	00000 to 65535
.S	Decimal, 16bit, signed	6byte	-32768 to +32767 (0 is expressed as +00000)
.D	Decimal, 32bit, unsigned	10byte	0000000000 to 4294967295
.L	Decimal, 32bit, signed	11byte	-2147483648 to +2147483647 (0 is expressed as 0000000000)
.H	Hex, 16bit	4byte	0000 to FFFF

Point

When specified in the data format of .U/.S/.H, the consecutive 16 bits will be processed.

- **When specified in the data format of .D/.L, the consecutive 32 bits will be processed.**
- **If any device (R002, MR311) other than the leading device of the channel is specified for the relay device, consecutive 16/32 bits will be processed by crossing over to the next channel.**

<DM, EM, FM, ZF, W, TM, Z, AT, CM, VM>



* n: Number of read data specified when sending command

Data 1 to n: The values stored in devices in turn from the specified device No..
The data range displayed varies with the data format specified when sending command.

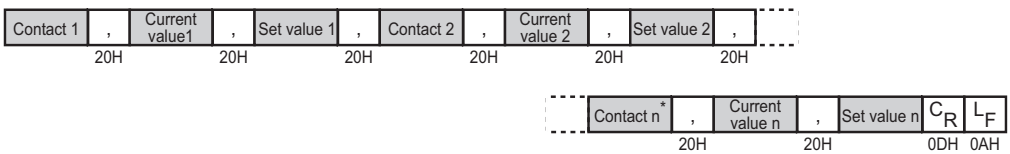
Specified data format		Data 1 to n	
		size	range
.U (can be omitted)	Decimal, 16bit, unsigned	5byte	00000 to 65535
.S	Decimal, 16bit, signed	6byte	-32768 to +32767 (0+00000)
.D	Decimal, 32bit, unsigned	10byte	0000000000 to 4294967295
.L	Decimal, 32bit, signed	11byte	-2147483648 to +2147483647 (0is expressed as 0000000000)
.H	Hex, 16bit	4byte	0000 to FFFF

Point

If Z is specified in the format of .U/.S/.H, the value of lower 16 bits will be displayed.

- **If AT is specified in the format of .U/.S/.H, the value of lower 16 bits will be displayed.**

<T, C, CTC, CTH>



* n: Number of read data specified when sending command

Contact 1 to n, current value 1 to n, set value 1 to n

: Displays the values stored in device in turn from the specified device No..
The data range displayed varies with the data format specified when sending command.
(For CTH, values of contact and set value are stored as fixed value 0)

Specified data format		Data 1 to n		Current value 1 to n, set value 1 to n	
		size	range	size	range
.U	Decimal, 16bit, unsigned	1byte	0 (OFF) or 1 (ON)	5byte	00000 to 65535
.S	Decimal, 16bit, signed			6byte	-32768 to +32767 (0 is expressed as +00000)
.D (can be omitted)	Decimal, 32bit, unsigned			10byte	0000000000 to 4294967295
.L	Decimal, 32bit, signed			11byte	-2147483648 to +2147483647 (0 is expressed as 0000000000)
.H	Hex, 16bit			4byte	0000 to FFFF

Point

When specified in the data format of .U/.S/.H, the value of lower 16 bits will be displayed.

<TC, CC>



* n: Number of read data specified when sending command

Data 1 to n: the values stored in devices in turn from the specified device No..
The data range displayed varies with the data format specified when sending command.

Specified data format		Data 1 to n	
		size	range
.U	Decimal, 16bit, unsigned	5byte	00000 to 65535
.S	Decimal, 16bit, signed	6byte	-32768 to +32767 (0 is expressed as +00000)
.D (can be omitted)	Decimal, 32bit, unsigned	10byte	0000000000 to 4294967295
.L	Decimal, 32bit, signed	11byte	-2147483648 to +2147483647 (0 is expressed as 0000000000)
.H	Hex, 16bit	4byte	0000 to FFFF

Point

If the format of .U/.S/.H is specified, the value of lower 16 bits will be displayed.

<TS, CS>



* n: Number of read data specified when sending command

Set value 1 to n: Displays the values stored in device in turn from the specified device No..
The data range displayed varies with the data format specified when sending command.

Specified data format		Set value 1 to n	
		size	range
.U	Decimal, 16bit, unsigned	5byte	00000 to 65535
.S	Decimal, 16bit, signed	6byte	-32768 to +32767 (0 is expressed as +00000)
.D (can be omitted)	Decimal, 32bit, unsigned	10byte	0000000000 to 4294967295
.L	Decimal, 32bit, signed	11byte	-2147483648 to +2147483647 (0 is expressed as 0000000000)
.H	Hex, 16bit	4byte	0000 to FFFF

Point

When specified in the data format of .U/.S/.H, the value of lower 16 bits will be displayed.

■ Error response

E	0	C_R	L_F
45H	30H	0DH	0AH

E0 : Device No. error

E	1	C_R	L_F
45H	31H	0DH	0AH

E1 : Command error

" Response in case of exception", page 8-32

■ Example of commands and responses

● Read R100 to R103 in the data format of "bit"

Command

R	D	S	␣	R	1	0	0	␣	4	C_R
52H	44H	53H	20H	52H	31H	30H	30H	20H	34H	0DH

Response

1	␣	0	␣	1	␣	0	C_R	L_F
31H	20H	30H	20H	31H	20H	30H	0DH	0AH

R100:ON R101:OFF R102:ON R103:OFF

● Read DM200 to DM202 in the data format of .S

Command

R	D	S	␣	D	M	2	0	0	.	S	␣	3	C_R
52H	44H	53H	20H	44H	4DH	32H	30H	30H	2EH	53H	20H	33H	0DH

Response

+	1	5	0	2	5	␣	−	2	5	4	0	0	␣	+	0	0	0	0	0	C_R	L_F
2BH	31H	35H	30H	32H	35H	20H	2DH	32H	35H	34H	30H	30H	20H	2BH	30H	30H	30H	30H	30H	0DH	0AH

DM200 = +15025 DM201 = -25400 DM202 = 0

Read Consecutive Data "RDE"

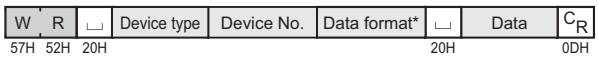
RDE command is compatible with Ethernet unit KV-LE20A. Its operation is the same as RDS.

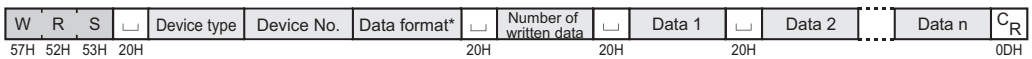
"Data Read "RD"/Consecutive Data Read "RDS"", page 8-16

Write Data " WR"/Write Consecutive Data "WRS"

WR : Writes data to specified device.
WRS : Writes specified number of consecutive data.

■ Command





* The data format (suffix) of device is specified as .U/.S/.D/.L/.H/(not specified).
.U : Decimal, 16bit, unsigned
.S : Decimal, 16bit, signed
.D : Decimal, 32bit, unsigned
.L : Decimal, 32bit, signed
.H : Hex, 16bit
(Not specified): Depends on device type
" Data simultaneity when the data format is specified as .D/.L", page 8-33

Reference For individual device specifying method for "WR"/"WRS"command, see page 8-18.

● Devices when using KV-5500 and KV-EP21V

Device type		Device No. *1	Data format not specified	Number of written devices	
Device name		KV-5500/5000/3000		Bit /.U/.S/.H	.D/.L
Relay *2	R (can be omitted)	00000 to 99915	(Bit)	0001 to 1000	0001 to 0500
Link relay	B	0000 to 3FFF	(Bit)	0001 to 1000	0001 to 0500
Internal auxiliary relay *2	MR	00000 to 99915	(Bit)	0001 to 1000	0001 to 0500
Latch relay *2	LR	00000 to 99915	(Bit)	0001 to 1000	0001 to 0500
Control relay	CR	0000 to 3915	(Bit)	0001 to 1000	0001 to 0500
Work relay	VB	0000 to 3FFF	(Bit)	0001 to 1000	0001 to 0500
Data memory *2	DM	00000 to 65534	.U	0001 to 1000	0001 to 0500
Extended data memory *2	EM	00000 to 65534	.U	0001 to 1000	0001 to 0500
File register *2	FM	00000 to 32767	.U	0001 to 1000	0001 to 0500
	ZF	00000 to 131071	.U	0001 to 1000	0001 to 0500
Link register	W	0000 to 3FFF	.U	0001 to 1000	0001 to 0500
Temporary data memory	TM	000 to 511	.U	001 to 512	001 to 256
Index register	Z	01 to 12	.U	01 to 12	01 to 12
Timer (current value) *4	T *3, TC	0000 to 3999	.D	001 to 120	001 to 120
Timer (set value) *4	TS	0000 to 3999	.D	001 to 120	001 to 120
Counter (current value) *4	C *3, CC	0000 to 3999	.D	001 to 120	001 to 120
Counter (set value) *4	CS	0000 to 3999	.D	001 to 120	001 to 120
High-speed counter *4	CTH	0 to 1	.D	1 to 2	1 to 2
High-speed counter comparator *4	CTC *5	0 to 3	.D	1 to 4	1 to 4
Control memory	CM	0000 to 5999	.U	0001 to 1000	0001 to 0500
Work memory	VM	00000 to 59999	(Bit)	0001 to 1000	0001 to 0500

*1 Device No. and number of written devices support zero suppression.
*2 Relays, internal auxiliary relays, latch relays, data memories, extended data memories, and file registers can be expressed with XYM. " XYM Expression", page 8-33
*3 If timers and counters are specified, the current value will be written.
*4 If the data format of .U/.S/.H is specified, data will be written in lower 16 bits.
*5 If high-speed counter comparator (CTC) is specified, the set value will be written.

● Devices when using KV-NC1EP

Device name	Device type	Device No. *1	Data format not specified	Number of written devices*1	
				Bit /.U/.S/.H	.D/.L
Relay *2	R (can be omitted)	00000 to 59915	(Bit)	001 to 256	001 to 128
Link relay	B	0000 to 1FFF	(Bit)	001 to 256	001 to 128
Internal auxiliary relay*2	MR	00000 to 59915	(Bit)	001 to 256	001 to 128
Latch relay *2	LR	00000 to 19915	(Bit)	001 to 256	001 to 128
Control relay	CR	0000 to 8915	(Bit)	001 to 256	001 to 128
Work relay	VB	0000 to 1FFF	(Bit)	001 to 256	001 to 128
Data memory *2	DM	00000 to 32767	.U	001 to 256	001 to 128
Link register	W	0000 to 3FFF	.U	001 to 256	001 to 128
Temporary data memory	TM	000 to 511	.U	001 to 256	001 to 128
Index register	Z	01 to 12	.U	01 to 12	01 to 12
Timer (current value)*4	T*3, TC	000 to 511	.D	01 to 64	01 to 64
Timer (set value)*4	TS	000 to 511	.D	01 to 64	01 to 64
Counter (current value)*4	C*3, CC	000 to 255	.D	01 to 64	01 to 64
Counter (set value)*4	CS	000 to 255	.D	01 to 64	01 to 64
High-speed counter*4	CTH	0 to 3*6	.D	1 to 4	1 to 4
High-speed counter comparator*4	CTC*5	0 to 7*6	.D	1 to 8	1 to 8
Control memory	CM	0000 to 8999	.U	001 to 256	001 to 128
Work memory	VM	0000 to 9999	(Bit)	001 to 256	001 to 128

*1 Device No. and number of written devices support zero suppression.

*2 Relays, internal auxiliary relays, latch relays, data memories, extended data memories, and file registers can be expressed with XYM. " XYM Expression", page 8-33

*3 If timers (T) and counters (C) are specified, the current value will be written.

*4 If the data format of .U/.S/.H is specified, data will be written in lower 16 bits, and 0 will be written in upper 16 bits.

*5 If high-speed counter comparator (CTC) is specified, the set value will be written.

*6 The Device No. which can be used differ according to the base unit.
KV-NC32T: CTH0 to CTH2 CTC0 to CTC5
KV-N24: CTH0 to CTH1 CTC0 to CTC3
KV-N40: CTH0 to CTH2 CTC0 to CTC5
KV-N60: CTH0 to CTH3 CTC0 to CTC7

■ Response

O	K	C_R	L_F
4FH	4BH	0DH	0AH

OK: During normal command processing, code "OK" is prompted.

■ Error response

E	0	C_R	L_F	E0 : Device No. Error
45H	30H	0DH	0AH	

E	1	C_R	L_F	E1 : Command Error
45H	31H	0DH	0AH	

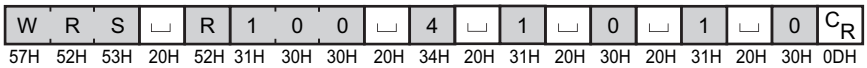
E	4	C_R	L_F	E4 : Write Protected
45H	34H	0DH	0AH	

" Response in case of exception", page 8-32

■ Example of commands and responses

● Write in R100 to R103 in the data format of "bit"

Command

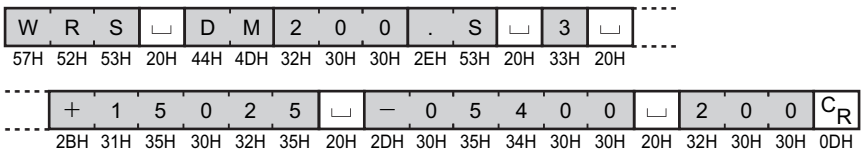


Response



● Write in DM200 to DM202 in the data format of .S

Command



Response



Reference Written data support zero suppression. For positive data, "+" can be omitted.

Write Consecutive Data "WRE"

WRE command is compatible with Ethernet unit KV-LE20A. Its operation is the same as WRS.

"Write Data " WR"/Write Consecutive Data "WRS"", page 8-21

Write Set Value "WS"/Write Consecutive Set Value "WSS"

WS/WSS command is compatible with Ethernet unit KV-LE20A. Its operation is the same as WR/WRS. However, "Device type" can only be specified as "T", "C", and "CTC". When "T" or "C" is specified, the set value will be written.

"Write Data " WR"/Write Consecutive Data "WRS"", page 8-21

Register Monitor "MBS"/"MWS"

Registers the specified device to bit device register table (MBS) or word device register table (MWS). At most 120 data can be registered.

MBS : Register bit device in monitor.
MBS : Register word device in monitor.

■ Command

<Register bit device in monitor>



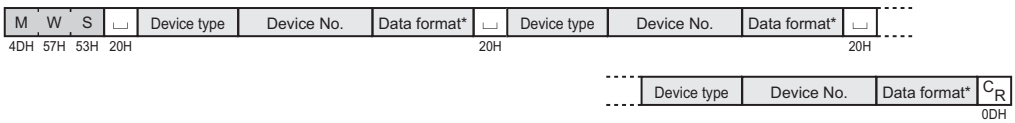
Device type		Device No. *1	
Device name		KV-5500/5000/3000	KV Nano
Relay *2	R (can be omitted)	00000 to 99915	00000 to 59915
Link relay	B	0000 to 3FFF	0000 to 1FFF
Internal auxiliary relay*2	MR	00000 to 99915	00000 to 59915
Latch relay *2	LR	00000 to 99915	00000 to 19915
Control relay	CR	0000 to 3915	0000 to 8915
Timer	T	0000 to 3999	000 to 511
Counter	C	0000 to 3999	000 to 255
High-speed counter Comparator (contact)	CTC	0 to 3	0 to 7*3
Work relay	VB	0000 to 3FFF	0000 to 1FFF

*1 Device No. supports zero suppression.

*2 Relays, internal auxiliary relays, latch relays, data memories, extended data memories, and file registers can be expressed with XYM.
" XYM Expression", page 8-33

*3 The Device No. which can be used differ according to the base unit.
KV-NC32T: CTH0 to CTH2 CTC0 to CTC5
KV-N24: CTH0 to CTH1 CTC0 to CTC3
KV-N40: CTH0 to CTH2 CTC0 to CTC5
KV-N60: CTH0 to CTH3 CTC0 to CTC7

<Register bite device in monitor>



* The data format (suffix) of device is specified as .U/.S/.D/.L/.H/(not specified).

.U : Decimal, 16bit, unsigned

.S : Decimal, 16bit, signed

.D : Decimal, 32bit, unsigned

.L : Decimal, 32bit, signed

.H : Hex, 16bit

(Not specified): depends on device type

" Data simultaneity when the data format is specified as .D/.L", page 8-33

● Devices when using KV-5500 and KV-EP21V

Device type		Device No. *1	Data format not specified
Device name		KV-5500/5000/3000	
Relay *2*3	R (can be omitted)	00000 to 99915	.U
Link relay *3	B	0000 to 3FFF	.U
Internal auxiliary relay *2*3	MR	00000 to 99915	.U
Latch relay *2*3	LR	00000 to 99915	.U
Control relay *3	CR	0000 to 3915	.U
Work relay	VB	0000 to 3FFF	.U
Data memory *2	DM	00000 to 65534	.U
Extended data memory *2	EM	00000 to 65534	.U
File register *2	FM	00000 to 32767	.U
Link register	W	0000 to 3FFF	.U
Temporary data memory	TM	000 to 511	.U
Index register	Z	01 to 12	.U
Timer (current value)	TC	0000 to 3999	.D
Timer (set value)	TS	0000 to 3999	.D
Counter (current value)	CC	0000 to 3999	.D
Counter (set value)	CS	0000 to 3999	.D
High-speed counter	CTH	0 to 1	.D
High-speed counter comparator (set value)	CTC	0 to 3	.D
Digital trimmer	AT	0 to 7	.D
Control memory	CM	0000 to 5999	.U
Work memory	VM	0000 to 59999	.U

*1 Device No. supports zero suppression.

*2 Relays, internal auxiliary relays, latch relays, data memories, extended data memories, and file registers can be expressed with XYM.

" XYM Expression", page 8-33

*3 Relays, link relays, internal auxiliary relays, latch relays, and control relays are registered by channel. Leading device should be specified when setting.

● Devices when using KV-NC1EP

Device type / Device name		Device No. *1	Data format not specified
Relay*2*3	R (can be omitted)	00000 to 59915	.U
Link relay*3	B	0000 to 1FFF	.U
Internal auxiliary relay*2*3	MR	00000 to 59915	.U
Latch relay*2*3	LR	00000 to 19915	.U
Control relay*3	CR	0000 to 8915	.U
Work relay	VB	0000 to 1FFF	.U
Data memory*2	DM	00000 to 32767	.U
Link register	W	0000 to 3FFF	.U
Temporary data memory	TM	000 to 511	.U
Index register	Z	01 to 12	.U
Timer (current value)	TC	000 to 511	.D
Timer (set value)	TS	000 to 511	.D
Counter (current value)	CC	000 to 255	.D
Counter (set value)	CS	000 to 255	.D
High-speed counter	CTH	0 to 3 *4	.D
High-speed counter comparator (set value)	CTC	0 to 7 *4	.D
Control memory	CM	0000 to 8999	.U
Work memory	VM	0000 to 9999	.U

*1 Device No. supports zero suppression.

*2 Relays, internal auxiliary relays, latch relays, data memories, extended data memories, and file registers can be expressed with XYM.

" XYM Expression", page 8-33

*3 Relays, link relays, internal auxiliary relays, latch relays, and control relays are registered by channel. The leading device should be specified when setting.

*4 The Device No. which can be used differ according to the base unit.

KV-NC32T: CTH0 to CTH2 CTC0 to CTC5
KV-N24: CTH0 to CTH1 CTC0 to CTC3
KV-N40: CTH0 to CTH2 CTC0 to CTC5
KV-N60: CTH0 to CTH3 CTC0 to CTC7

■ Response

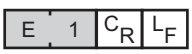


OK: During normal command processing, code "OK" is prompted.

■ Error response



E0 : Device No. error



E1 : Command error

" Response in case of exception", page 8-32

Read Monitor "MBR"/"MWR"

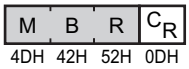
Reads the device value in device register table.

MBR : Reads the value of bit device registered in monitor.

MWR : Reads the value of word device registered in monitor.

■ Command

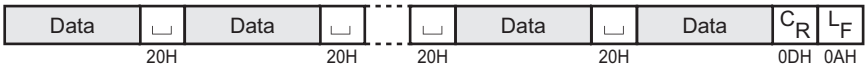
<To read bit device register table. >



<To read word device register table. >



■ Response



Data : Enters the monitor result of the device registered in bit device register table or word device register table. The format of monitor result is the same as that of response to RDS command*.

* Read monitor is available only to current value for CTH, and to set value for CTC.

■ Error response



E1: Command error

" Response in case of exception", page 8-32

Read Comments "RDC"

Reads comments of specified device.

■ Command

R	D	C	␣	Device type	Device No.	C_R
52H	44H	43H	20H			0DH

Device type		Device No. *1	
Device name		KV-5500/5000/3000	KV Nano
Relay *2	R (can be omitted)	00000 to 99915	00000 to 59915
Link relay	B	0000 to 3FFF	0000 to 1FFF
Internal auxiliary relay*2	MR	00000 to 99915	00000 to 59915
Latch relay *2	LR	00000 to 99915	00000 to 19915
Control relay	CR	0000 to 3915	0000 to 8915
Data memory *2	DM	00000 to 65534	00000 to 32767
Extended data memory *2	EM	00000 to 65534	-
File register *2	FM	00000 to 32767	-
	ZF	000000 to 131071	-
Link register	W	0000 to 3FFF	0000 to 3FFF
Temporary data memory	TM	000 to 511	000 to 511
Index register	Z	01 to 12	01 to 12
Timer	T	0000 to 3999	000 to 511
Counter	C	0000 to 3999	000 to 255
High-speed counter	CTH	0 to 1	0 to 3 *3
High-speed counter comparator	CTC	0 to 3	0 to 7 *3
Control memory	CM	0000 to 5999	0000 to 8999

*1 Device No. supports zero suppression.

*2 Relays, internal auxiliary relays, latch relays, data memories, extended data memories, and file registers can be expressed with XYM.

" XYM Expression", page 8-33

*3 The Device No. which can be used differ according to the base unit.

KV-NC32T: CTH0 to CTH2 CTC0 to CTC5
KV-N24: CTH0 to CTH1 CTC0 to CTC3
KV-N40: CTH0 to CTH2 CTC0 to CTC5
KV-N60: CTH0 to CTH3 CTC0 to CTC7

■ Response

Data	C_R	L_F
	0DH	0AH

Data : Enters the device comments specified by command (32 characters). If the comments are less than 32 characters, space (20H) should be added.

■ Error response



E0 : Device No. error



E1 : Command error



E6 : No comment

" Response in case of exception", page 8-32

Point

In case of writing under RUN, even if comments are registered in the specified device, response "E6" will be added in case of exception.

BANK Switching "BE"

Switches the bank of file register.

Point

KV-NC1EP (KV Nano Series) does not respond to the BANK Switching "BE" instruction. If one is received, a "E1: Instruction error" response will be sent back.

■ Command



BANK No.: BANK No. of file register should be specified within the range of 0 to 3.

■ Response



OK: During normal command processing, code "OK" is prompted.

■ Error response



E0 : Device No. error



E1 : Command error

" Response in case of exception", page 8-32

Read Expansion Unit Buffer Memory "URD"

Reads expansion unit buffer memory data of specified quantity consecutively.

■ Command



*1 Unit No. : Unit No. should be specified within the range of 00 to 48.

*2 Address : The address of expansion unit buffer memory should be specified within the range of 00000 to 32767.

*3 Data format : The data format (suffix) of device should be specified as .U/.S/.D/.L/.H/(not specified).

.U : Decimal, 16bit, unsigned
.S : Decimal, 16bit, signed
.D : Decimal, 32bit, unsigned
.L : Decimal, 32bit, signed
.H : Hex, 16bit
(Not specified): Depends on device type

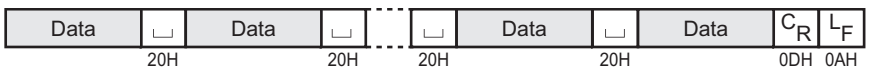
" Data simultaneity when the data format is specified as .D/.L", page 8-33

The method to specify data format is the same as RD/RDS command.

"Data Read "RD"/Consecutive Data Read "RDS"", page 8-16

*4 Number of read data: If the data format is specified as .U/.S/.H, it should be specified within the range of 0001 to 1000.
If the data format is specified as .D/.L, it should be specified within the range of 0001 to 0500.

■ Response



Data : The data stored in the expansion unit buffer memory of specified address. The format of read result is the same as that of response of RDS command.

■ Error response



E0 : Device No. error



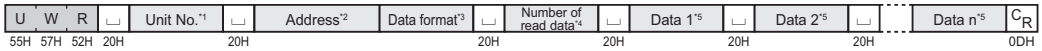
E1 : Command error

" Response in case of exception", page 8-32

Write Expansion Unit Buffer Memory "UWR"

Writes specified number of consecutive data into the expansion unit buffer memory.

■ Command



*1 Unit No. : Specifies the unit No. within the range of 00 to 48.

*2 Address : Specifies the address of expansion unit buffer memory within the range of 00000 to 32767.

*3 Data format : The data format (suffix) of device should be specified as .U/.S/.D/.L/.H/(not specifies).

- .U : Decimal, 16bit, unsigned
- .S : Decimal, 16bit, signed
- .D : Decimal, 32bit, unsigned
- .L : Decimal, 32bit, signed
- .H : Hex, 16bit

(Not specified): Depends on device type

" Data simultaneity when the data format is specified as .D/.L", page 8-33

The method to specify data format is the same as WR/WRS command.

"Write Data " WR"/Write Consecutive Data "WRS"", page 8-21

*4 Number of written data: If the data format is specified as .U/.S/.H, it should be specified within the range of 0001 to 1000.

If the data format is specified as .D/.L, it should be specified within the range of 0001 to 0500.

*5 Data 1 to n : Specifies the data to be written in the expansion unit buffer memory. (N represents number of written data)

■ Response



OK: During normal command processing, code "OK" is prompted.

■ Error response



E0 : Device No. error



E1 : Command error

" Response in case of exception", page 8-32

Response in case of exception

A response different from normal one will be returned if a wrong command is sent or an exception occurs in the CPU unit. Response details, causes and measures to be taken in case of exception are shown below.

Code	Description	Cause	Measures
E0	Abnormal device No.	• The specified device No., BANK No., unit No. or address is out of range. • The specified timer, counter, CTH or CYC No. is unavailable in the program. • Not registered in monitor, but read monitor is executed.	• Specify a No. within the given range. • Check program and specify a No. used in the program. • Register in monitor before executing read monitor.
E1	Abnormal command	• Unsupported command is sent. • The method to specify command is incorrect.	• Send correct command after checking the command.
E2	Program not registered	• M1 command (switch to RUN mode) is sent in the condition that no program is registered in CPU unit. • M1 command (switch to RUN mode) is sent in the condition that the RUN/PROG switch of CPU unit is in PROG mode.	• Send the command after program is registered in CPU unit. • Switch the RUN/PROG switch of CPU unit to RUN mode.
E4	Write disabled	• Try to change set values of timer, counter and CTC against program to which write is disabled.	• Send the command again after program write is enabled.
E5	Unit error	• "Command M1 (switch to RUN mode)" is sent when the error of CPU unit is not removed.	• Send the command again after the CPU unit error is removed.
E6	No comments	• Comments are not registered in the selected device of read comments command (RDC). • Failed to read the comments due to high load of PLC.	• If required, register the comments in device. • Execute when the load of PLC is lower or try again.

XYM Expression

For relay, internal auxiliary relay, latch relay, data memory, extended data memory and file register, devices can be specified based on XYM expression in the following table.

KV STUDIO User's Manual

Device name	KEYENCE expression	XYM expression	Device No. in XYM expression	
			KV-5500/5000/3000	KV Nano
Relay	R	X	0000 to 999F	0000 to 599F
		Y	0000 to 999F	0000 to 599F
Internal auxiliary relay	MR	M	00000 to 15999	00000 to 15999
Latch relay	LR	L	00000 to 15999	0000 to 3199
Data memory	DM	D	00000 to 65534	00000 to 32767
Extended data memory	EM	E	00000 to 65534	-
File register	FM	F	00000 to 32767	-

Data simultaneity when the data format is specified as .D/.L

If the data format of R, B, MR, LR, CR, DM, EM*, FM*, ZF*, W, TM, CM, VB, and VM is specified as .D/.L, the device of specified device No. is lower 16 bits, the device of next No. is upper 16 bits, and the device will be processed as 32-bit data.

Only when the device No. is an even number, the simultaneity of upper 16 bits and lower 16 bits can be ensured.

* EM, FM and ZF cannot be used when KV-NC1EP is being used.

MEMO

9

MC PROTOCOL COMMUNICATION FUNCTION

This chapter describes the operating principle, communication settings, command and response of MC protocol communication.

9-1 MC Protocol Communication Function 9-2
9-2 Communication Specification 9-3
9-3 Communication Procedure 9-6
9-4 Command List 9-12
9-5 Description of the Command and Response 9-13

9-1 MC Protocol Communication Function

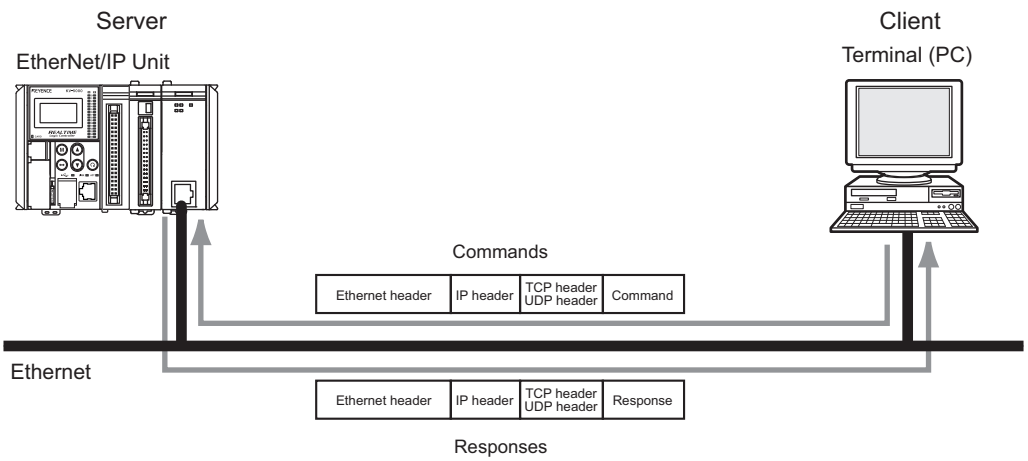
This section gives a general description on MC protocol communication.

■ Application

The device values of CPU unit can be read/written by sending commands in preset format from a terminal (such as PC) connected to Ethernet.
The ladder program for communication is not required on CPU unit because a response is automatically returned to commands sent from external units.

■ Overview of communication

By creating a communication program on the terminal (PC), data can be read from/written into the CPU unit, and the operation status can be monitored by sending commands to the EtherNet/IP Unit via the Ethernet from the terminal (PC), and receiving responses via the Ethernet from the EtherNet/IP Unit. During communication, PLC equipped with EtherNet/IP Units serve as servers, terminals (such as PCs) serve as clients. The server automatically returns to the client the appropriate response to commands received from the client.
MC protocol communication supports TCP/IP and UDP/IP communication protocols.
EtherNet/IP Units support ASCII code communication and binary code communication based on QnA compatible 3E frame and 4E frame.



* MC protocol is the abbreviation of MELSEC communication protocol, MELSEC is the registered trademark of Mitsubishi Electric Corporation.

9-2 Communication Specification

Check Settings in Unit Editor

When the EtherNet/IP Unit is used in MC protocol communication, make sure that the settings in Unit Editor satisfy the following conditions. If the settings does not satisfy the following conditions, please change the settings in Unit Editor. For the setting method, see "3-1 Unit Editor Setting", page 3-2.

Item	Settings	Setting range	Default value	See page
Leading DM No.	Please set No. not for any other purpose.	0 to 65304	To be set	3-6
Number of used DMs	Number of DMs used by unit	230	230	
Leading relay No. (set up by channel)	Please set No. not for any other purpose.	10 to 960	To be set	3-6
Number of relays used	Number of relays used by the unit	640	640	-
Communication rate	Please set up according to the network used.	100M/10Mbps automatic 10Mbps	100M/10Mbps automatic	3-6
IP address setting method	To set up IP address setting method.	Fixed IP address/ BOOTP->Fixed IP auto switching/BOOTP	Fixed IP address	3-6
IP address	Please set up a IP address not duplicated with other nodes.	0.0.0.0 to 255.255.255.255	192.168.0.10	3-7
Subnet mask	Please set up appropriate subnet mask.	0.0.0.0 to 255.255.255.255	255.255.255.0	3-7
Default gateway	Please set up appropriate default gateway.	0.0.0.0 to 255.255.255.255	0.0.0.0	3-7
Receive time out [s]	Please set to an appropriate value.	0 to 59	10	3-8
Keep-alive [s]	Please set to an appropriate value.	0 to 65535	600	3-8
Routing setting	Please set up as required.	Enable/Disable	Disable	3-10
Target IP address 1 to 6	Please set up as required.	0.0.0.0 to 255.255.255.255	0.0.0.0 (Disable)	3-10
Target subnet mask 1 to 6	Please set up as required.	0.0.0.0 to 255.255.255.255	0.0.0.0 (Disable)	3-10
Router IP address 1 to6	Please set up as required.	0.0.0.0 to 255.255.255.255	0.0.0.0 (Disable)	3-10
MC protocol port No. (TCP)	Change as required.	1 to 65535	5000	3-9
MC protocol port No. (UDP)	Change as required.	1 to 65535	5000	3-9
MC protocol communication code	Change as required.	Binary/ASCII	Binary	3-15

Item	Settings	Setting range	Default value	See page
MC protocol name code	Change as required.	0000 to FFFF(H)	0033(H): when KV-3000 is used 0034(H): when KV-5000 is used 0035(H): when KV-5500 is used 0080(H): when KV-NC32T is used 0084(H): when KV-N60** is used 0085(H): when KV-N40** is used 0086(H): when KV-N24** is used	3-15
MC protocol name	Change as required.	<= 16 characters in ASCII character string	V3000: when KV-3000 is used V5000: when KV-5000 is used V5500: when KV-5500 is used KV-NC32: when KV-NC32T is used KV-N60: when KV-N60** is used KV-N40: when KV-N40** is used KV-N24: when KV-N24** is used	3-15

MC Protocol Communication Specification

The communication control of EtherNet/IP Units is based on TCP/IP and UDP/IP. Specification of TCP/IP and UDP/IP communication is as follows.

■ TCP/IP

Item	Description
Communication mode	TCP/IP
Used port No.	5000 (Changeable)
Number of sockets	15 (common for higher-lever link communication)
Supported frame	QnA compatible 3E frame, 4E frame
Data code	Binary code/ASCII code

■ UDP/IP

Item	Description
Communication mode	UDP/IP
Used port No.	5000 (Changeable)
Number of slots	1
Supported frame	QnA compatible 3E frame, 4E frame
Data code	Binary code/ASCII code

Device used for MC Protocol Communication

Device used for MC protocol communication function is as follows.

Item	Device No.	Read/write
Send times	Leading DM + 0 to 1	Read
Receive times	Leading DM + 2 to 3	Read
Error code (EtherNet/IP Unit)	Leading DM + 20	Read
MAC address	Leading DM + 13 to 15	Read

Point

0 is stored in the error DM (leading DM + 20) if no error occurs on the EtherNet/IP Unit. In case of error, the corresponding error No. will be stored in this DM. For error details, see "A-4 Error List", page A-4.

9-3 Communication Procedure

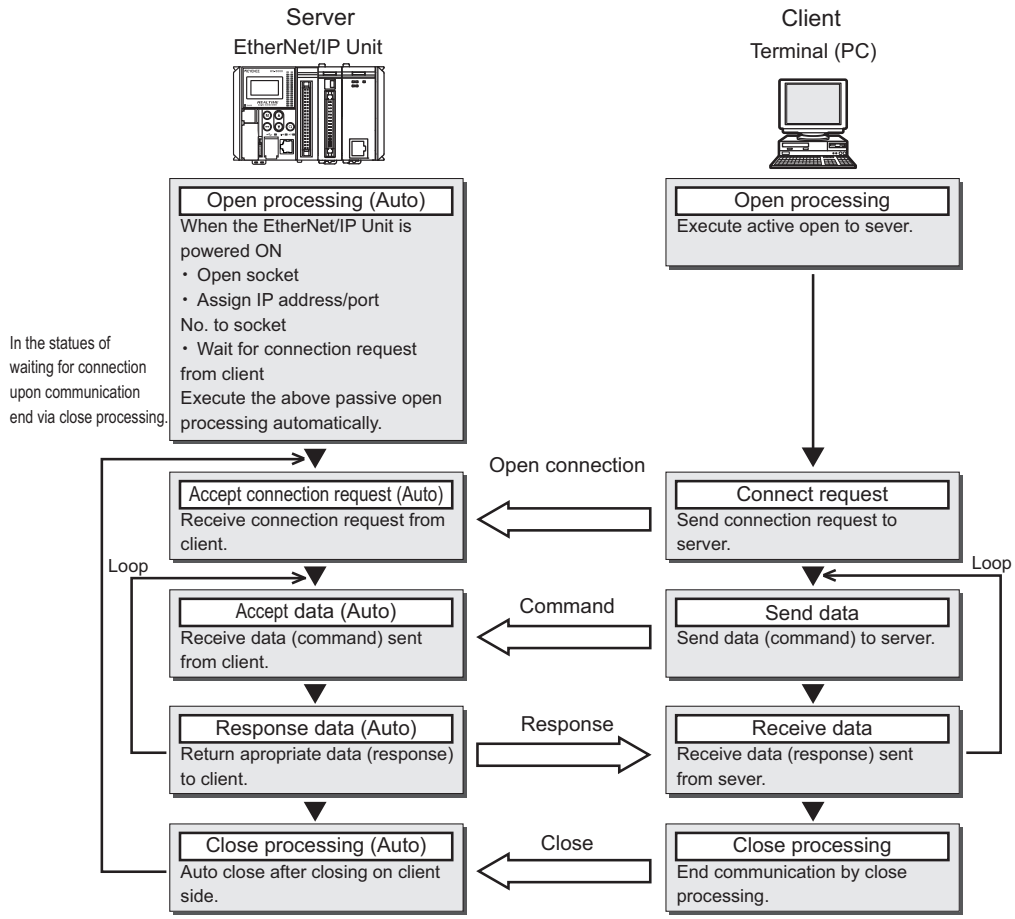
This section describes the principle of communication between EtherNet/IP Units and a terminal (e.g. PC) on the network using the MC protocol communication function, as well as the format of commands and responses.

Communication Principle

MC protocol communication supports TCP/IP and UDP/IP communication protocols.
The following describes the communication principles based on TCP/IP and UDP/IP protocols.

■ Communication principle based on TCP/IP protocol

Communication principle based on TCP/IP protocol is as follows.
During communication, the EtherNet/IP Unit serves as a server, and the communication target terminal (e.g. PC) serves as a client.
The EtherNet/IP Unit automatically responds to the requests from the client.

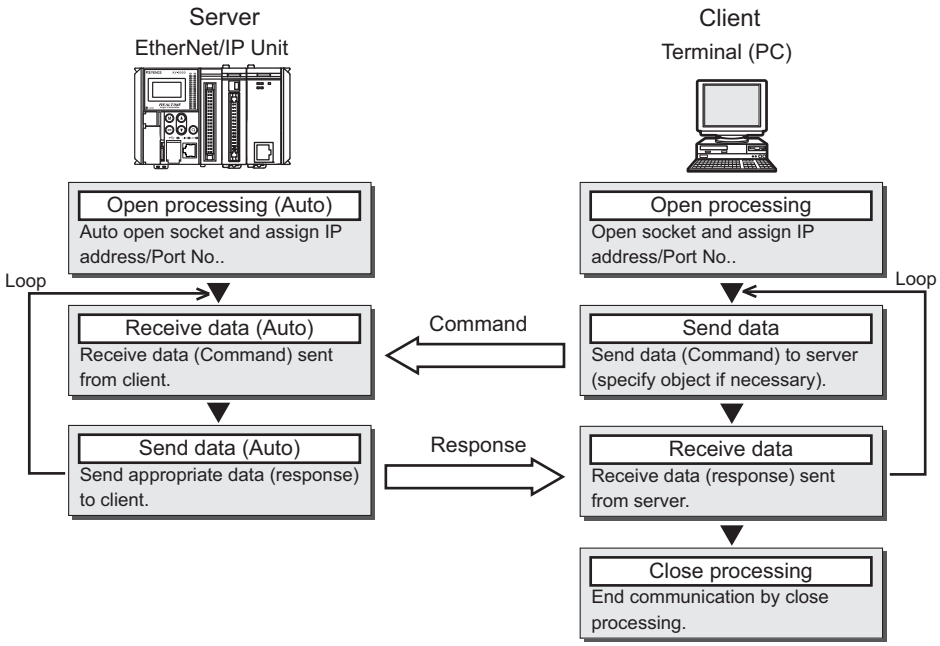


■ Communication principle based on UDP/IP protocol

Communication principle based on UDP/IP protocol is as follows.

During communication, the EtherNet/IP Unit serves as a server, and the communication target terminal (e.g. PC) serves as a client.

The EtherNet/IP Unit automatically responds to the requests from the client.



Data Format of MC Protocol

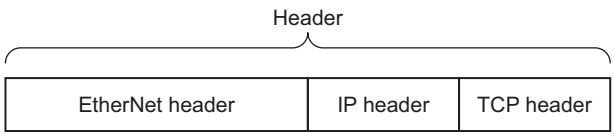
The data format of MC protocol consists of "header" and "application data".

Header	Application data

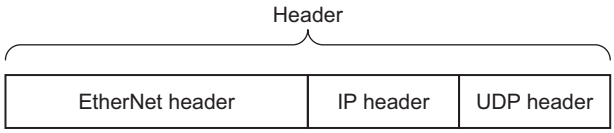
Data Format of Header

Data format of header is different in cases of TCP/IP and UDP/IP communication.

■ Format for TCP/IP communication

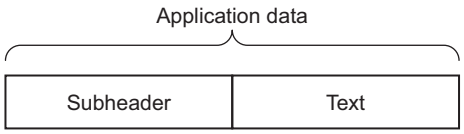


■ Format for UDP/IP communication



Application Data Format

Application data consists of "subheader" and "text". Subheader is used to identify whether the communication data is a command or a response. Text is the command or response itself.



■ Subheader format

Subheader format is different in cases of QnA compatible 3E frame and 4E frame.

- QnA compatible 3E frame

ASCII code

Command				Response			
5	0	0	0	D	0	0	0
35H	30H	30H	30H	44H	30H	30H	30H

Binary code

Command		Response	
50H	00H	D0H	00H

- 4E frame

ASCII code

Command												Response											
5	4	0	0	H	-	-	L	0	0	0	0	D	4	0	0	H	-	-	L	0	0	0	0
35H	34H	30H	30H					30H	30H	30H	30H	44H	34H	30H	30H					30H	30H	30H	30H
Serial No. *1												Serial No. *1											

Binary code

Command					Response				
		L	H				L	H	
54H	00H			00H	00H	D4H	00H		00H	00H
	Serial No. *1						Serial No. *1		

*1 Serial No. is used by external units to identify the response corresponding to the command. The EtherNet/IP Unit sends the response after attaching the same serial No. of command to it. The setting range is 0000 to FFFF(H).

■ Text format

The text format is identical in cases of QnA compatible 3E frame and 4E frame.

● Command

When executing ASCII code communication

Header	Subheader	Network No.	PC No.	Request destination unit I/O No.	Request destination unit station No.	Request data length	CPU monitor timer	Command	Subcommand	Request data
		H L	H L	H — — L	H L	H — — L	H — — L	H — — L	H — — L	
		0 0	F F	0 3 F F	0 0	0 0 1 8	0 0 1 0			
		30H 30H	46H 46H	30H 33H 46H 46H	30H 30H	30H 30H 31H 38H	30H 30H 31H 30H			

When executing binary code communication

Header	Subheader	Network No.	PC No.	Request destination unit I/O No.	Request destination unit station No.	Request data length	CPU monitor timer	Command	Subcommand	Request data
				L H		L H	L H	L H	L H	
		00H	FFH	FFH 03H	00H	0CH 00H	10H 00H			

Network No., PC No., request destination unit I/O No. and request destination unit station No. are fixed in EtherNet/IP Units. Please specify the following values.

Network No. : 00
PC No. : FF
Request destination unit I/O No. : 03FF
Request destination unit station No. : 00

Please specify request data length and CPU monitor timer as follows.

Request data length: specify the data length (in byte) from CPU monitor timer to request data.
CPU monitor timer : the value of CPU monitor timer is ignored in EtherNet/IP Units.

Point

When sending data, please set data length from subheader to request data to less than 8194 bytes.

● Response

When executing ASCII code communication

Header	Subheader	Network No.	PC No.	Request destination unit I/O No.	Request destination unit station No.	Response data length	End code	Response data
		H L	H L	H — — L	H L	H — — L	H — — L	
		0 0	F F	0 3 F F	0 0	0 0 0 C	0 0 0 0	
		30H 30H	46H 46H	30H 33H 46H 46H	30H 30H	30H 30H 30H 43H	30H 30H 30H 30H	

When executing binary code communication

Header	Subheader	Network No.	PC No.	Request destination unit I/O No.	Request destination unit station No.	Response data length	End code	Response data
				L H		L H	L H	
		00H	FFH	FFH 03H	00H	06H 00H	00H 00H	

The values same as those specified by the command are returned for Network No., PC No., request destination unit I/O No. and request destination unit station No..

Response data length: return the data length (in byte) from end code to response data.

End code : return the command processing result.
0000 will be returned in normal status.

● Error response

When executing ASCII code communication

Header	Subheader	Network No. (access station)	PC No. (access station)	Request destination unit I/O No.	Request destination unit station No.	Request data length	Other than endcode 0_H (when C051$_H$)	Error information: (response station) Network No.	Error information: (response station) PLC No.	Error information: Request destination unit I/O No.	Error information: Request destination unit station No.	Error information: Command	Error information: Subcommand
		H L	H L	H – – L	H L	H – – L	H – – L	H L	H L	H – – L	H L	H – – L	H – – L
		0 0	F F	0 3 F F	0 0	0 0 1 6	C 0 5 1	0 0	F F	0 3 F F	0 0		
		30H 30H	46H 46H	30H 33H 46H 46H	30H 30H	30H 30H 31H 36H	43H 30H 35H 31H	30H 30H	46H 46H	30H 33H 46H 46H	30H 30H		

When executing binary code communication

Header	Subheader	Network No. (access station)	PC No. (access station)	Request destination unit I/O No.	Request destination unit station No.	Request data length	Other than end code 0_H (when C051$_H$)	Error information: Network No. (response station)	Error information: PLC No. (response station)	Error information: Request destination unit I/O No.	Error information: Request destination unit station No.	Error information: Command	Error information: Subcommand
				L H		L H	L H			L H		L H	L H
		00H	FFH	FFH 03H	00H	0BH 00H	51H C0H	00H	FFH	FFH 03H	00H		

The values same as those specified by the command are returned for Network No., PC No., request destination unit I/O No. and request destination unit station No..

Response data length : return the data length (in byte) from end code to response data.

End code : return the command processing result.
Error code is returned in case of exception.
"End Code in case of Communication Error", page 9-31

Error information : The values same as those specified by the command are returned for Network No., PC No., request destination unit I/O No. and request destination unit station No., command and subcommand.

9-4 Command List

The command list of MC protocol communication is shown below.

Function	Data unit	Command	Subcommand	See page
Batch read	Bit	0401	0001	9-17
	Word	0401	0000	9-17
Batch write	Bit	1401	0001	9-18
	Word	1401	0000	9-18
Random read	Word	0403	0000	9-19
Random write	Bit	1402	0001	9-20
	Word	1402	0000	9-20
Register monitor	-	0801	0000	9-21
Read monitor	-	0802	0000	9-22
Batch read multiple blocks	Word	0406	0000	9-23
Batch write multiple blocks	Word	1406	0000	9-24
Read buffer memory	Word	0613	0000	9-25
Write buffer memory	Word	1613	0000	9-25
Read intelligent unit buffer memory	Word	0601	0000	9-26
Write intelligent unit buffer memory	Word	1601	0000	9-27
Remote RUN	-	1001	0000	9-28
Remote STOP	-	1002	0000	9-28
Read CPU model.	-	0101	0000	9-29
Loopback test	-	0619	0000	9-30

9-5 Description of the Command and Response

Notices on using Commands

■ Device expression

The device expression of PLC from Mitsubishi Electric is used for specifying device.

● Devices for KV-5500/5000/3000

Device name	Device in KV-5500/5000/3000	Device in MC protocol	Device code	
			ASCII	Binary
Relay	R00000 to R99915	X(Y)0000 to X(Y)3E7F*2	X*(Y*)	9C(9D)
Link relay	B0000 to B3FFF	B0000 to B3FFF*2	B*	A0
Internal auxiliary relay	MR00000 to MR99915	M00000 to M15999	M*	90
Latch relay	LR00000 to LR99915	L00000 to L15999	L*	92
Control relay	CR0000 to CR3915	SM0000 to SM0639	SM	91
Control memory	CM0000 to CM5999	SD0000 to SD5999	SD	A9
Data memory	DM00000 to DM65534	D00000 to D65534	D*	A8
Extended data memory	EM00000 to EM65534	D100000 to D165534	D*	A8
File register	FM00000 to FM32767	R00000 to R32767	R*	AF
	ZF000000 to ZF131071	ZR00000 to ZR1FFFF*2	ZR	B0
Link register	W0000 to 3FFF	W0000 to 3FFF*2	W*	B4
Timer (current value)*1	T0000 to T3999	TN0000 to TN3999	TN	C2
Timer (contact)	T0000 to T3999	TS0000 to TS3999	TS	C1
Counter (current value) *1	C0000 to C3999	CN0000 to CN3999	CN	C5
Counter (contact)	C0000 to C3999	CS0000 to CS3999	CS	C4

*1 Current value of timer and counter of KV-5500/5000/3000 is processed as per 32 bits. Under MC protocol communication, only lower 16 bits are read/written. If current value exceeds the expression range of 16 bits, 65535 is read.

*2 Device No. is expressed by hex number.
Device No. of other devices is expressed by decimal number.

● Devices for KV Nano

Device name	Device in KV Nano	Device in MC protocol	Device code	
			ASCII	Binary
Relay	R00000 to R59915	X(Y)0000 to X(Y)257F*2	X*(Y*)	9C(9D)
Link relay	B0000 to B1FFF	B0000 to B1FFF*2	B*	A0
Internal auxiliary relay	MR00000 to MR59915	M00000 to M15999	M*	90
Latch relay	LR00000 to LR19915	L00000 to L3199	L*	92
Control relay	CR0000 to CR8915	SM0000 to SM0639	SM	91
Control memory	CM0000 to CM8999	SD0000 to SD5999	SD	A9
Data memory	DM00000 to DM32767	D00000 to D32767	D*	A8
Link register	W0000 to 3FFF	W0000 to 3FFF*2	W*	B4
Timer (current value)*1	T000 to T511	TN000 to TN511	TN	C2
Timer (contact)	T000 to T511	TS000 to TS511	TS	C1
Counter (current value) *1	C000 to C255	CN000 to CN255	CN	C5
Counter (contact)	C000 to C255	CS000 to CS255	CS	C4

*1 Current value of timer and counter of KV Nano Series is processed as per 32 bits. Under MC protocol communication, only lower 16 bits are read/written. If current value exceeds the expression range of 16 bits, 65535 is read.

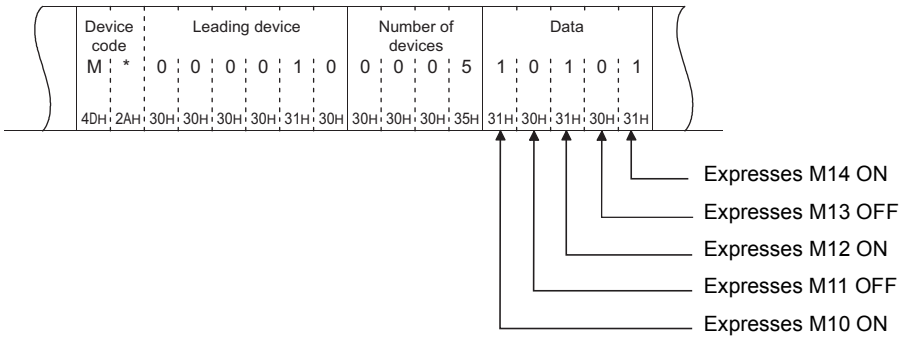
*2 Device No. is expressed by hex number.
Device No. of other devices is expressed by decimal number.

■ Device and data format in case of ASCII code communication

In case read/write bit device by bit

If bit device is specified in bit, in the sequence from left to right, for the specified number of devices from the specified device, ON is expressed as "1" (31H), and OFF is "0" (30H).

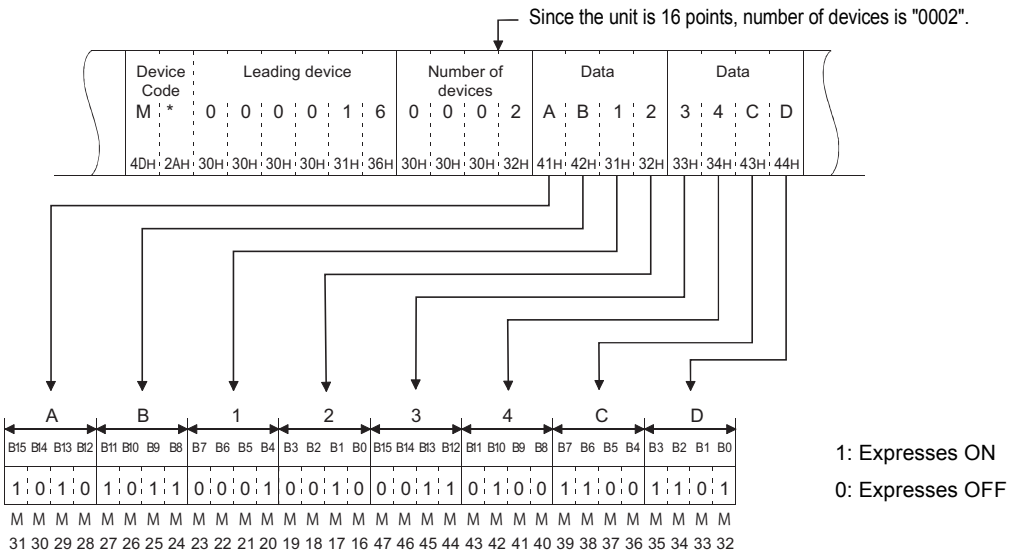
For example) ON/OFF expression of 5 devices from M10



In case read/write bit device by word

If bit device is specified in word, in the sequence from upper bit to lower bt, every 4 bits as a unit, 16 devices from the specified device are expressed by hex number.

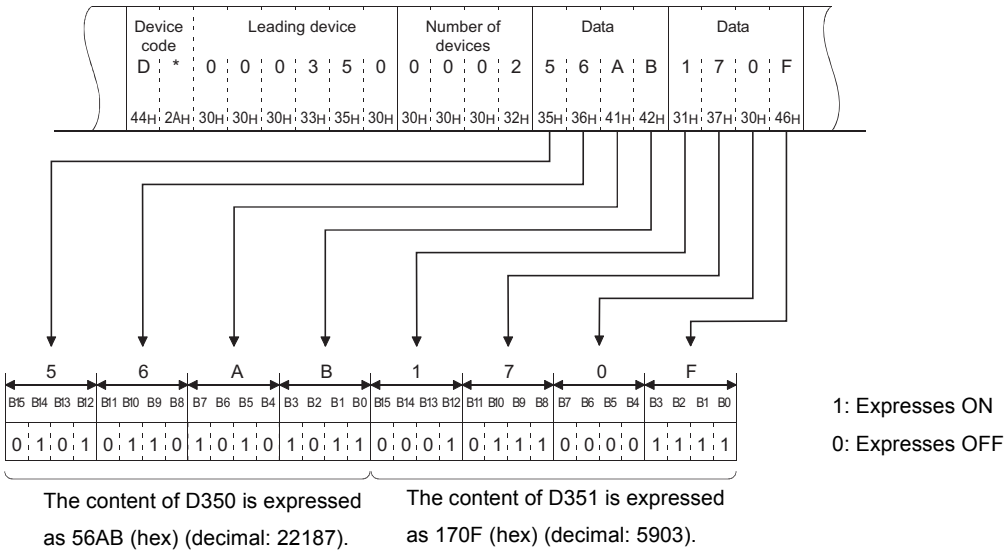
For example) ON/OFF expression of 32 devices from M16



In case read/write word device

For word device, every 4 bits is taken as a unit, in the sequence from upper bit to lower bit, 1 word is expressed by hex number.

For example) Expression of storage contents of data registers of D350, and D351

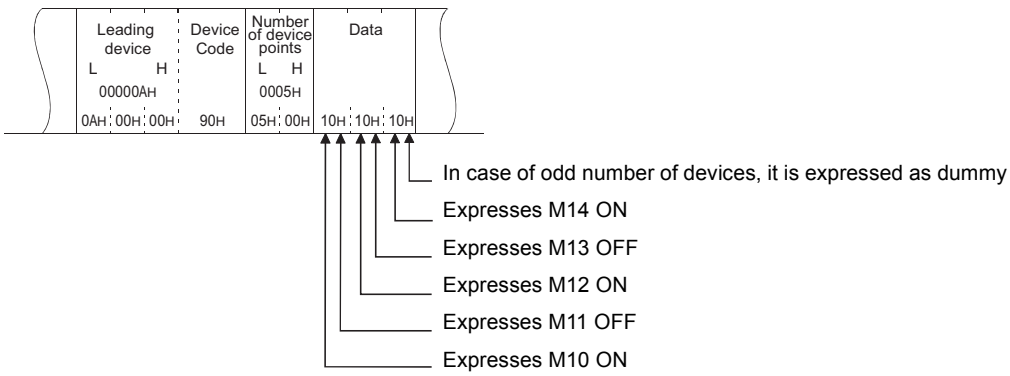


■ Device and data format in case of binary code communication

In case read/write bit device by bit

If bit device is specified in bit, 4 bits are used to specify 1 point, in the sequence from upper bit to lower bit, for the specified number devices from the specified device, ON is expressed as "1", and OFF is "0".

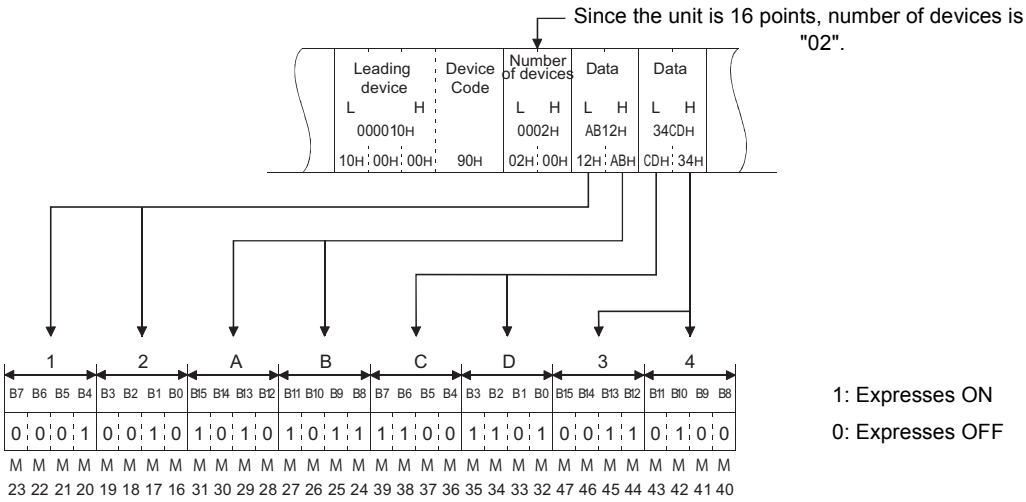
For example) ON/OFF expression of 5 devices from M10



In case read/write bit device by word

If bit device is specified in word, 1 bit is used to specify 1 point, the specified number of devices from the specified device are expressed in the sequence of lower byte (L: bit 0 to 7), upper byte (H: bit 8 to 15), every 16 points is taken as a unit.

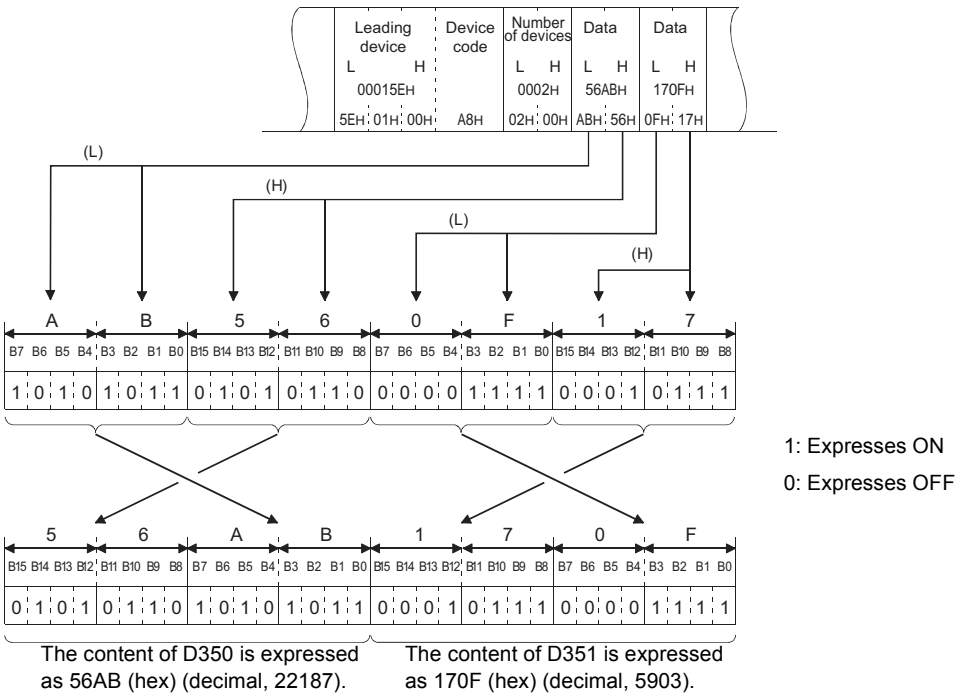
For example) ON/OFF expression of 32 devices from M16



In case read/write word device

For word device, every 16 bits is used to specify 1 word, the specified number of devices from the specified device are expressed in the sequence of lower byte (L: bit 0 to 7), upper byte (H: bit 8 to 15), every 1 point is taken as a unit.

For example) Expression of storage content of data registers of D350, and D351

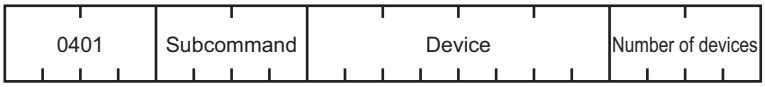


Batch Read [0401]

This command is used to read the data of the specified number of consecutive devices.

■ Command

Binary



ASCII

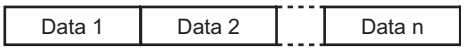
Subcommand: Read device by bit if 0001 is specified.
Read device by word if 0000 is specified.

Number of specifiable devices

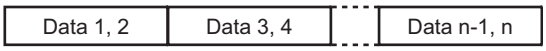
	ASCII code communication	Binary code communication
Specify by bit	1 to 3584	1 to 7168
Specify by word	1 to 960	1 to 960

■ Response

By bit (ASCII)



By bit (binary), with even number of devices



By bit (binary), with odd number of devices



By word

Binary



ASCII

*2 If any device (X002, Y311 etc) other than leading device of the channel is specified for the bit device, consecutive 16 bits will be processed by crossing over to the next channel in case of reading by word.

Batch Write [1401]

This command is used to write data to the specified number of consecutive devices.

■ Command

Binary



ASCII

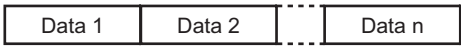
Subcommand: Write device by bit if 0001 is specified.
Write device by word if 0000 is specified.

Number of specifiable devices

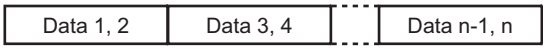
	ASCII code communication	Binary code communication
Specify by bit	1 to 3584	1 to 7168
Specify by word	1 to 960	1 to 960

Data format is as follows.

By bit (ASCII)



By bit (binary), with even number of devices



By bit (binary), with odd number of devices



By word

Binary



ASCII

* If any device (X002, Y311 etc) other than leading device of the channel is specified for the bit device, consecutive 16 bits will be processed by crossing over to the next channel in case of writing by word.

■ Response

There is no response data.

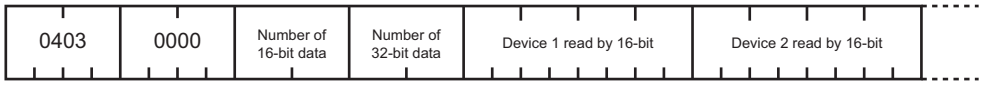
Header, subheader, Network No., PC No., request destination unit I/O No., request destination unit station No., response data length and end code are returned.

Random Read [0403]

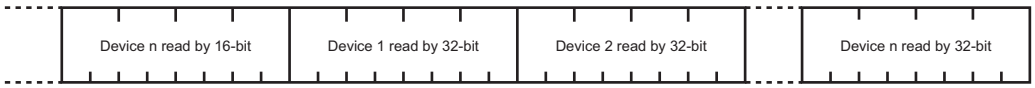
This command is used to specify device individually and read data by 16-bit and 32-bit.

■ Command

Binary



ASCII



Specify number of 16-bit data, and number of 32-bit data within the following range.
(number of 16-bit data + number of 32-bit data) <= 192
Number of data is specified as follows.

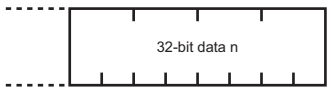
5 : Specify 05.
20 : Specify 14.

*1 Random read with specified monitor condition is unavailable.

*2 If any device (X002, Y311 etc) other than leading device of the channel is specified for the bit device, consecutive 16 bits will be processed by crossing over to the next channel.

■ Response





Random Write [1402]

This command is used to specify device individually and write data.

■ Command

By word

Subcommand is specified as 0001.

Binary



ASCII

Maximum number of devices is 188, which is specified as follows.

5 : Specify 05.

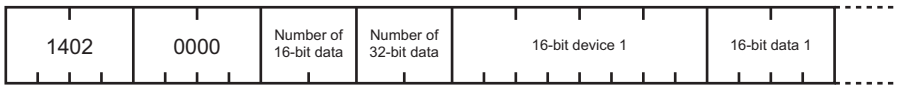
20 : Specify 14.

Data: Specify 01 at ON, and 00 at OFF.

By word

Subcommand is specified as 0000.

Binary



ASCII





Specify number of 16-bit data, and number of 32-bit data within the following range.

(number of 16-bit data x 12 + number of 32-bit data x 14) <= 1920

Number of data is specified as follows.

5 : Specify 05.

20 : Specify 14.

* If any device (X002, Y311) other than the leading one of the channel is specified for the bit device in word, consecutive 16 bits will be processed by crossing over to the next channel.

■ Response

There is no response data.

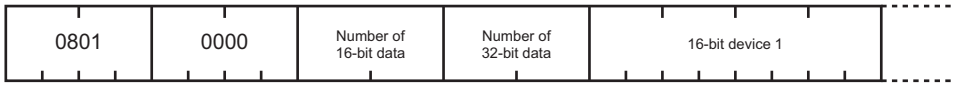
Header, subheader, Network No., PC No., request destination unit I/O No., request destination unit station No., response data length and end code are returned.

Register Monitor [0801]

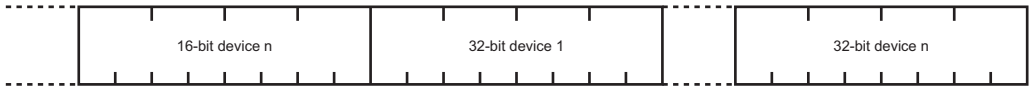
This command is used to register the specified device to register table by 16-bit and 32-bit.

■ Command

Binary



ASCII



Specify number of 16-bit data, and number of 32-bit data within the following range.
(number of 16-bit data + number of 32-bit data) <= 192
Number of data is specified as follows.

5 : Specify 05.
20 : Specify 14.

*1 Register monitor with monitor condition specified is unavailable.
*2 For TCP/IP communication, register monitor operates independently for each connection, therefore, register monitor and read monitor can be executed for multiple units.
*3 If power supply of CPU unit is cut off, the monitored register information will be lost.
*4 If any bit device (X002, Y311) other than the leading one of the channel is specified for the bit device, process consecutive 16 bits will be processed by crossing over to the next channel.

■ Response

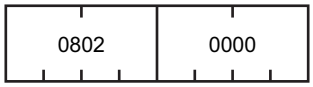
There is no response data.
Header, subheader, Network No., PC No., request destination unit I/O No., request destination unit station No., response data length and end code are returned.

Read Monitor [0802]

This command is used to read the contents of device registered on register table.

■ Command

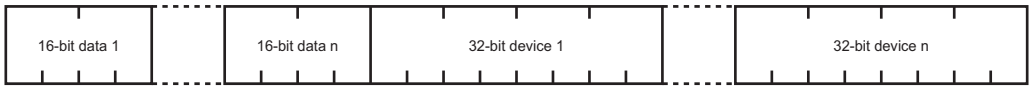
Binary



ASCII

* For TCP/IP communication, register monitor operates independently for each connection, therefore, register monitor and read monitor can be executed for multiple units.

■ Response

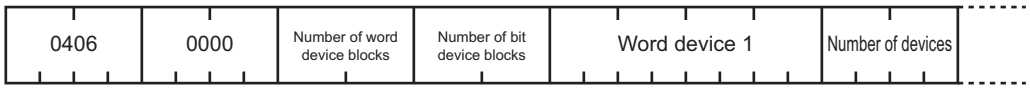


Batch Read Multiple Blocks [0406]

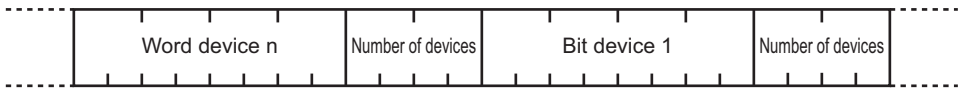
This command is used to read multiple blocks in the form of regarding consecutive devices as one block.

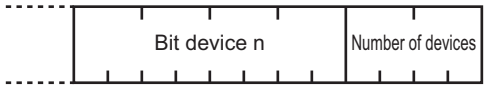
■ Command

Binary



ASCII





The number of word device blocks and number of bit device blocks should be specified within the following range.

(number of word device blocks + number of bit device blocks) <= 120

(Total number of words of word device blocks + total number of words of bit device blocks) <= 960

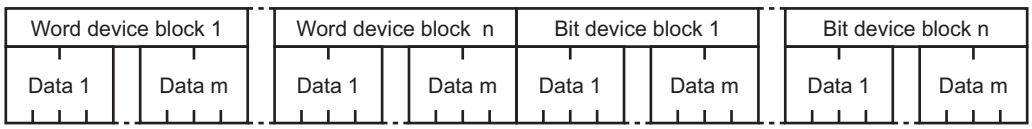
Please specify the number of blocks as follow.

5 : Specify 05.

20 : Specify 14.

* If any device (X002, Y311) other than the leading one of the channel is specified for the bit device, consecutive 16 bits will be processed by crossing over to the next channel.

■ Response

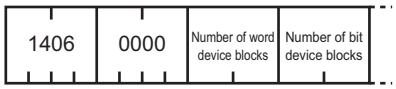


Batch Write Multiple Blocks [1406]

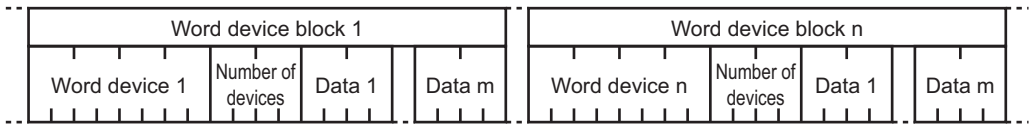
This command is used to write multiple blocks in the form of regarding consecutive devices as one block.

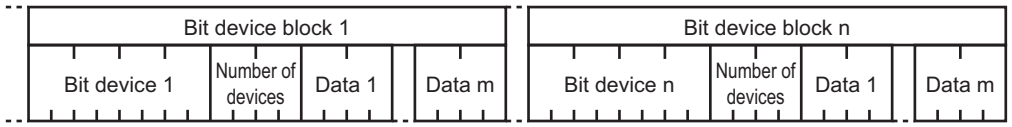
■ Command

Binary



ASCII





The number of word device blocks and number of bit device blocks should be specified within the following range.

(4 X (number of word device blocks + number of bit device blocks) + total number of words of word device blocks + total number of words of bit device blocks) <= 960

Please specify the number of blocks as follow.

5 : Specify 05.

20 : Specify 14.

* If any device (X002, Y311) other than the leading one of the channel is specified for the bit device, consecutive 16 bits will be processed by crossing over to the next channel.

■ Response

There is no response data.

Header, subheader, Network No., PC No., request destination unit I/O No., request destination unit station No., response data length and end code are returned.

Read Buffer Memory [0613]

This command is used to read the buffer memory of the EtherNet/IP Unit which received the command word by word.

■ Command

Binary



ASCII

Leading address: Specify the leading address of buffer memory within the range of 0000 to 7FFF (HEX).

Word length : Specify the number of words to be read within the range of 001 to 1E0 (HEX).

■ Response

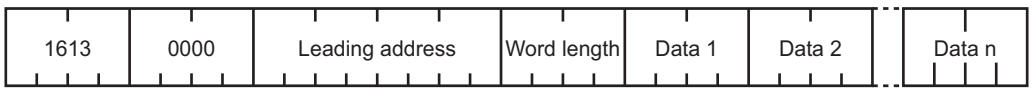


Write Buffer Memory [1613]

This command is used to write the buffer memory of the EtherNet/IP Unit which received the command word by word.

■ Command

Binary



ASCII

Leading address: Specify the leading address of buffer memory within the range of 0000 to 7FFF (HEX).

Word length : Specify the number of words to be read within the range of 001 to 1E0 (HEX).

■ Response

There is no response data.

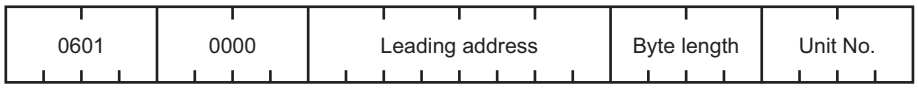
Header, subheader, Network No., PC No., request destination unit I/O No., request destination unit station No., response data length and end code are returned.

Read Intelligent Unit Buffer Memory [0601]

This command is used to read the buffer memory of intelligent units other than the EtherNet/IP Unit which received the command byte by byte.

■ Command

Binary



ASCII

Leading address: Specify the leading address of buffer memory in byte and even number.
The setting range is 0000 to FFFF (Hex).

Byte length : Specify an even number of words to be read by byte.
The setting range is 002 to 780 (Hex).

Unit No. : Specify unit No. in the way that the CPU unit is No. 0, the unit at its right is No. 1, the unit at the right of No. 1 unit is No. 2...
The setting range is 00 to 30 (Hex).

When reading 20 (decimal) words from the buffer memory address 0010 (hex), specify the leading address as 0020 (hex), and byte length as 028 (hex).

■ Response

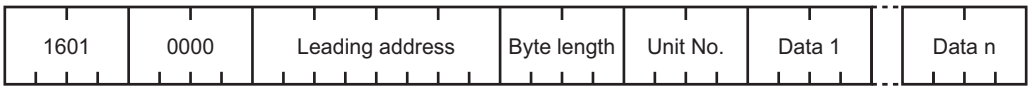


Write Intelligent Unit Buffer Memory [1601]

This command is used to write the buffer memory of intelligent units other than the EtherNet/IP Unit which received the command byte by byte.

■ Command

Binary



ASCII

Leading address: Specify the leading address of buffer memory in byte and even number.
The setting range is 0000 to FFFF (Hex).

Byte length : Specify an even number of words to be read by byte.
The setting range is 002 to 780 (Hex).

Unit No. : Specify unit No. in the way that the CPU unit is No. 0, the unit at its right is No. 1, the unit at the right of No. 1 unit is No. 2...
The setting range is 00 to 30 (Hex).

When reading 20 (decimal) words from the buffer memory address 0010 (hex), specify the leading address as 0020 (hex), and byte length as 028 (hex).

■ Response

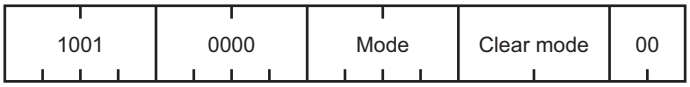
There is no response data.
Header, subheader, Network No., PC No., request destination unit I/O No., request destination unit station No., response data length and end code are returned.

Remote RUN [1001]

This command is used to set the CPU unit to RUN mode.

■ Command

Binary



ASCII

Mode : Specify as 0001 or 0003.
For EtherNet/IP Units, the operation is identical when either 0001 or 0003 is specified.

Clear mode : Specify any value.
For EtherNet/IP Units, irrelevant to the specified value, keep device memory value, set CPU unit to RUN mode directly.

■ Response

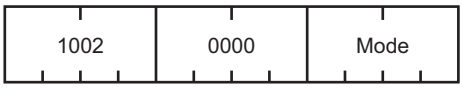
There is no response data.
Header, subheader, Network No., PC No., request destination unit I/O No., request destination unit station No., response data length and end code are returned.

Remote STOP [1002]

This command is used to set the CPU unit to PROGRAM mode.

■ Command

Binary



ASCII

Mode : Specify as 0001 or 0003.
For EtherNet/IP Units, the operation is identical when either 0001 or 0003 is specified.

■ Response

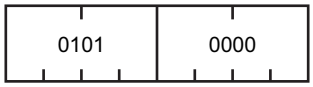
There is no response data.
Header, subheader, Network No., PC No., request destination unit I/O No., request destination unit station No., response data length and end code are returned.

Read CPU Model [0101]

This command is used to read CPU unit model.

■ Command

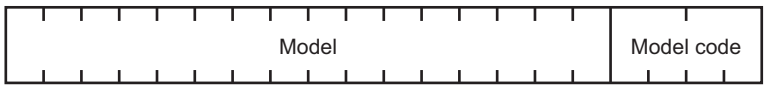
Binary



ASCII

■ Response

Binary



ASCII

Model : Return model of CPU unit as follows.
KV-5500 : V5500
KV-5000 : V5000
KV-3000 : V3000
KV-NC32T: KV-NC32
KV-N60**: KV-N60
KV-N40**: KV-N40
KV-N24**: KV-N24
KV-N14**: KV-N14
"Model" is also returned in ASCII code in case of binary code communication.
If the model is less than 16 bytes, 20H will be attached to return 16 btyes.

Model code : Return model code of CPU unit as follows.
KV-5500 : 35H
KV-5000 : 34H
KV-3000 : 33H
KV-NC32T: 80H
KV-N60**: 84H
KV-N40**: 85H
KV-N24**: 86H
KV-N14**: 87H

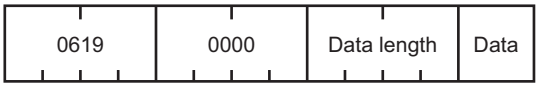
Reference You can change the model and model code of unit read into MC protocol name code and MC protocol name of Unit Editor.

Loopback Test [0619]

This command is used to check whether communication is available or not.

■ Command

Binary

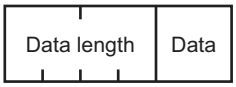


ASCII

Data length : Specify “Data” size (in byte) within the range of 0 to 960.
Data : Specify any data.

■ Response

Binary



ASCII

The data length and data same as that specified by the command will be returned.

End Code in case of Communication Error

An end code different from normal will be returned if a wrong command is sent or an exception occurs in the CPU unit. End code details, causes and measures to be taken in case of exception are shown below.

Code	Cause	Executed command
0000	Command is executed normally.	Common
**50*	• When 3E frame is used, other than 0x5000 is specified in the subheader. • When 4E frame is used, other than 0x5400 is specified in the subheader.	Common
**54*	ASCII code other than numerical value is specified in the subheader.	Common
C050	ASCII code other than numerical value is specified for non-subheader.	Common
4A00	The specified Network No. is not 0x00	Common
4B00	• The specified PC No. is not 0Xff. • The specified IO No. is not 0x03FF.	Common
C058	When executing ASCII code communication, the specified data is shorter than the set number of devices or number of blocks.	Common
C059	• The specified command is not supported. • The specified subcommand is not supported.	Common
C061	When executing binary code communication, the specified data is shorter than the set number of devices or number of blocks.	Common
C050	Unavailable device code is specified for ASCII code communication.	0401,1401,0403,1402,0406,1406
C05B	Unavailable device code is specified for binary code communication.	0401,1401,0403,1402,0406,1406
C056	The specified device No. is out of the range.	0401,1401,0403,1402,0406,1406
C051	The specified number of devices is out of the device range.	0401,1401,0403,1402,0406,1406
C05C	Subcommand is specified as "0001", but when executing the command to process bit device, word device is specified.	0401,1401,0403,1402,0406,1406
4080	Both number of word blocks and number of bit devices are specified as "0".	0406
C05D	Read monitor is executed before executing register monitor.	0802
C056	The specified buffer memory address does not exist in the unit.	0613,1613,0601,1601
C056	The specified buffer memory address is an odd No. .	0613,1613,0601,1601
4043	The specified unit does not exist.	0613,1613,0601,1601
4080	The specified mode value is not 1 or 3.	1001,1002
C05F	Try to switch to RUN mode in the status that no program is registered in CPU unit.	1001,1002
C051	Loopback data beyond 960 are received.	0619

* Enter the data creating the topmost bit of leading 1 byte of the subheader in “**”.
Example: if the subheader is 5FFF, ** is DF.

MEMO

10

MAIL SEND/RECEIVE

This chapter describes the operating principle, and communication settings of mail send/receive.

10-1 Mail Send/Receive 10-2
10-2 Basic Settings of Mail Send/Receive 10-4
10-3 PLC Event Mail Sending 10-8
10-4 Logging/Tracing Mail Sending 10-15
10-5 Mail Sending Based on Ladder 10-19
10-6 Unit-specific Command for Mail Send 10-23
10-7 Unit-specific Function for Mail Send 10-36
10-8 Mail Command Receiving 10-43
10-9 Mail Command Maker 10-49

10-1 Mail Send/Receive

This section describes the functions available for mail send/receive.

Overview of Mail Send/Receive

Mail send/receive function enables to send CPU unit information from KV-EP21V to external unit by mailing.
In addition, the command can be executed by receiving mail from external unit.
The following functions are available with mail send/receive.

■ Mail send/receive

● PLC event mail sending

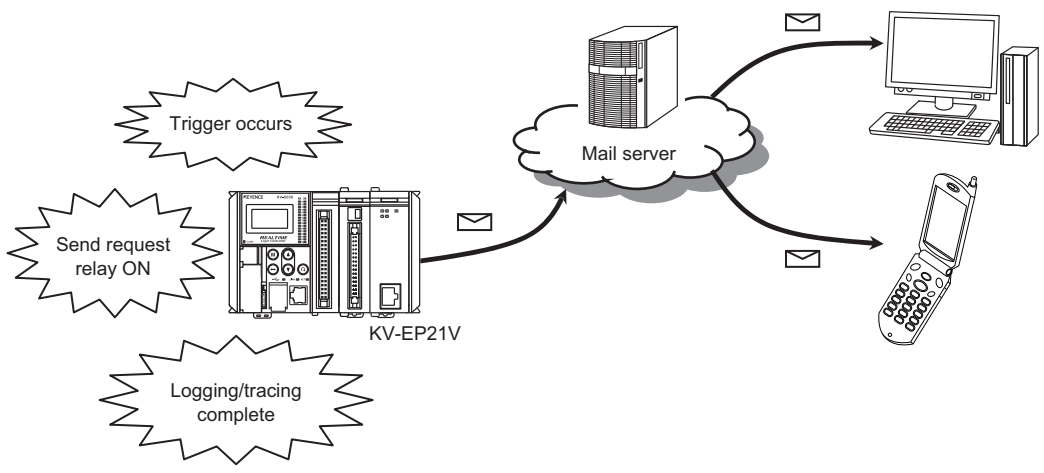
Mail is sent with the trigger set as PLC status change, fixed period, or device value change.
For trigger set as PLC status change, PLC status is programmed to mail.
For trigger set as fixed period, or device value change, the specified device value is programmed attached or to mail for sending.
"PLC Event Mail Sending", page 10-8

● Logging/tracing mail sending

Mail is sent after logging/tracing file is created in CPU unit.
Logging/tracing file can be attached to mail.
"Logging/Tracing Mail Sending", page 10-15

● Mail sending based on Ladder

Mail is sent after contents of mail is programmed with Ladder, and mail send request relay is ON.
"Mail Sending Based on Ladder", page 10-19
"Unit-specific Command for Mail Send", page 10-23
"Unit-specific Function for Mail Send", page 10-36

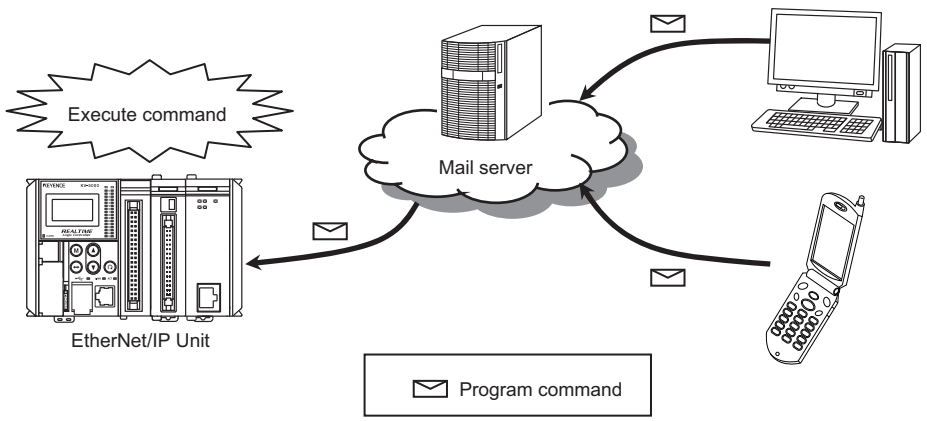


■ Mail command receiving function

The command is executed by receiving mail with programmed command. After executing the command, the response is programmed to mail, to return. With this function, certain host-link commands and mail-specific commands can be executed. In addition, Mail Command Maker can also be used to create command mail to send to EtherNet/IP Unit easily.

"Mail Command Receiving", page 10-43

"Mail Command Maker", page 10-49



10-2 Basic Settings of Mail Send/Receive

This section describes necessary settings for mail Send/Receive function.

Check Settings in Unit Editor

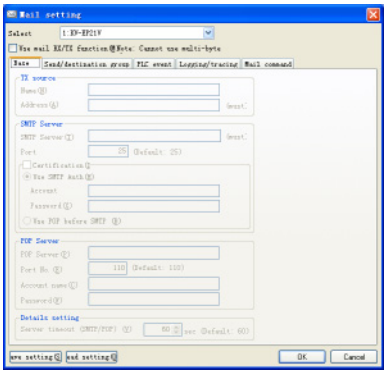
The settings in Unit Editor should satisfy the following conditions if the EtherNet/IP Unit is used for mail send/receive. If the settings do not satisfy the following conditions, please change the settings in Unit Editor. For setting details, see "3-1 Unit Editor Setting", page 3-2.

Item	Settings	Setting range	Default value	See page
Leading DM No.	To set up a No. not used in other purposes.	0 to 65304	To be set	3-6
Number of DMs in use	Number of DMs used by the unit	230	230	3-6
Leading relay No. (set up by channel)	To set up a No. not used in other purposes.	10 to 960	To be set	3-6
Number of relays in use	Number of relays used by the unit	640	640	-
Baud rate	Please set up according to the network used.	100M/10Mbps automatic/ 10Mbps	100M/10Mbps automatic	3-6
Setting method of IP address	To set up IP address setting method.	Fixed IP address/ BOOTP->Fixed IP auto switching/BOOTP	Fixed IP address	3-6
IP address	Please set up a IP address not duplicated with other nodes.	0.0.0.0 to 255.255.255.255	192.168.0.10	3-7
Subnet mask	Please set up appropriate subnet mask.	0.0.0.0 to 255.255.255.255	255.255.255.0	3-7
Default gateway	Please set up appropriate default gateway.	0.0.0.0 to 255.255.255.255	0.0.0.0	3-7
Receive time out [s]	Please set to an appropriate value.	0 to 59	10	3-8
Keep Alive [s]	Please set to an appropriate value.	0 to 65535	600	3-8
Route setting	Please set up as required.	Enable/Disable	Disable	3-10
Target IP address 1 to 6	Please set up as required.	0.0.0.0 to 255.255.255.255	0.0.0.0 (Disable)	3-10
Target subnet mask 1 to 6	Please set up as required.	0.0.0.0 to 255.255.255.255	0.0.0.0 (Disable)	3-10
Router IP address 1 to 6	Please set up as required.	0.0.0.0 to 255.255.255.255	0.0.0.0 (Disable)	3-10
DNS server	Please set up as required.	0.0.0.0 to 255.255.255.255	0.0.0.0 (Disable)	3-8

Startup of Mail Setting Tool

In order to use mail send/receive function, KV STUDIO should be used to execute settings.
The following ways are available to open the setting window.

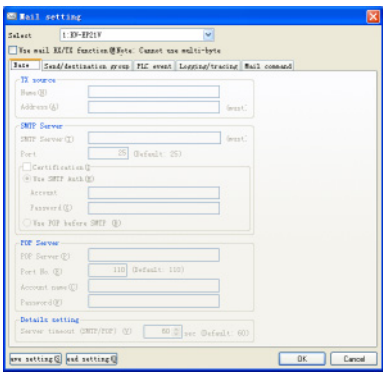
- Select "Tool (T)" ▶"Setup mail" from the menu in turn
- Click  button
- Click mail setting on Unit Editor
- Click  button on Unit Editor



Item	Description
Select unit	To select the unit to which mail send/receive function will be set up.
Use mail RX/TX function	Check it to enable mail send/receive function.

Basic

Basic items for using mail send/receive function can be set up in Basic tab.



Category	Item	Description
TX source	Name	To set up the name of the sender EtherNet/IP Unit.
	Address	To set up the address of the sender EtherNet/IP Unit.*1
SMTP server	SMTP server	To set up the IP address or host name of SMTP server. *1*2
	Port No.	To set up within the range of 1 to 65535. (Default value: 25)*1
	Certification	Check it if SMTP authentication or POP before SMTP is used. • In case of SMTP authentication Select "Use SMTP Auth", set account name, and password. • In case of POP before SMTP Select "Use POP before SMTP".
POP server	POP server	To set up the IP address or host name of POP server. *2*3
	Port No.	To set up within the range of 1 to 65535. (Default value: 110)*3
	Account name	To set up the account name for login POP server.*3
	Password	To set up the password used for login POP server.*3
Details setting	Server time out (SMTP/POP)	To set up within the range of 30 to 300 [s]. (Default value: 60)*1

*1 To use mail send/receive function, these items must be set.

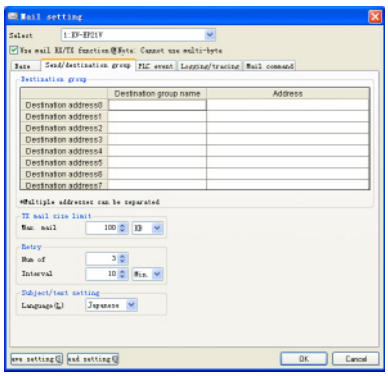
*2 To specify host name of SMTP server or POP server, DNS server must be specified in Unit Editor.

"3-1 Unit Editor Setting", page 3-2

*3 To use mail command receiving function, these items must be set.

Sender/Receiver Group

Receiver setting for mail send and mail send operation can be set up in this tab.



Category	Item	Description	Default value
Destination group	Destination group name	To setup receiver group name. Up to 256 half-width characters can be set.	-
	Address	Set sending source address of the receiver. *1	-
TX mail size limit	Max. mail size (value)	100 to 10240 (KB) 1 to 10 (MB)	100
	Max. mail size (unit)	KB/MB	KB
Retry	Num of retries	0 to 3	3
	Interval (value)	1 to 24 (h) 1 to 1440 (min) 30 to 3600 (s)	10
	Interval (unit)	H/min/s	Min
Subject/text setting	Language	Japanese/English	Japanese

*1 With "," for separation, multiple addresses can be set.

10-3 PLC Event Mail Sending

This section describes mail sending based on PLC event.

Overview of PLC Event Mail Sending

Mail is sent with the trigger set as PLC status change, fixed period, or device value change.
Multiple triggers can be used simultaneously.

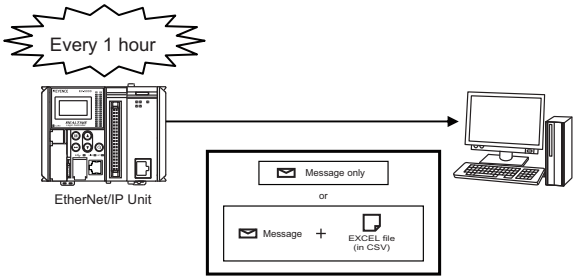
■ PLC status change

The EtherNet/IP Unit sends mail upon PLC status change (error occurrence/removal, PROG->RUN, power on etc).
The content of PLC status change is programmed in the mail for sending.



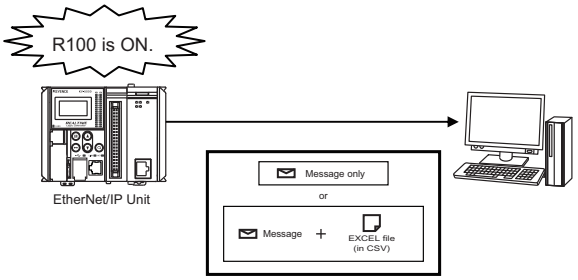
■ Fixed period

The EtherNet/IP Unit sends mail in each fixed period.
When trigger occurs, device value can be acquired.
The acquired device value can be programmed in mail or attached to mail in CSV file format.



■ Device change

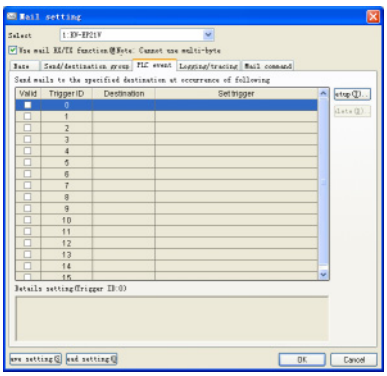
When the set device value changes, the EtherNet/IP Unit sends mail.
When trigger occurs, device value can be acquired.
The acquired device value can be programmed in mail or attached to mail in CSV file format.



PLC Event

PLC event mail sending can be setup in this tab.

Up to 16 triggers can be set.



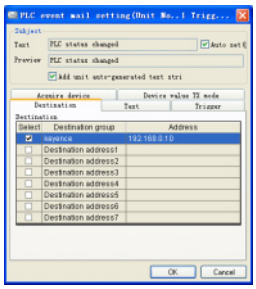
Item	Description
Valid	If checked, the selected trigger ID is valid. If trigger ID is not set, double click to open PLC event mail settings dialog box.
Setup	Press "Setup" button to display PLC event mail settings dialog box. The selected trigger ID can be set.
Delete	Press "Delete" button to delete settings of selected ID.

"Startup of Mail Setting Tool", page 10-5

"PLC event mail settings dialog box", page 10-10

PLC event mail settings dialog box

Details of PLC event mail can be set up in this dialog box.



Item	Description
Text	To set up character string displayed in the title. Up to 32 half-width characters can be set.
Preview *1	To preview title .
Auto set	If checked, the title is set automatically.
Add unit auto-generated text string	If checked, content of PLC event is attached automatically.

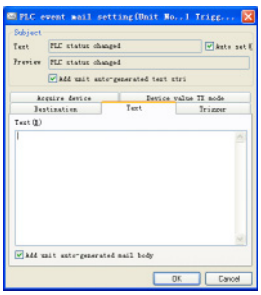
*1 When "#CCCC" is displayed in preview, record the latest error No. in "#CCCC" is recorded in decimal format.

■ Receiver

Check receiver group to send mail.

■ Text

Set the content to be written by the user in mail text.



Item	Description
Text	To set up text content. Up to 256 half-width characters can be set.
Add unit auto-generated mail body	If checked, content of PLC event is attached automatically.

■ Trigger

Select trigger type from the following options.

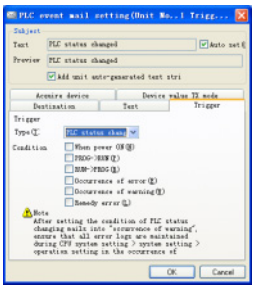
- PLC status change
- Fixed cycle
- Device change

When "PLC status change" is selected

Select PLC status change that is set to trigger.

Multiple triggers can be set.

Mail can be sent when CPU unit is in PROG/RUN mode.



Item	Description
When power ON	Mail is sent upon power ON of CPU unit. *1
PROG->RUN	Mail is sent upon the mode of CPU unit switching from PROGRAM to RUN. *2
RUN->PROG	Mail is sent upon the mode of CPU unit switching from RUN to PROGRAM. *2
Occurrence of major error	Mail is sent upon major error occurs. *3 *5
Occurrence of warning	Mail is sent upon minor error occurs. *4 *5
Remedy error	Mail is sent upon error is removed.

*1 For send mail upon power on, mail is not sent immediately upon power on but after 1 minute.

*2 PROG ->RUN, and RUN ->PROG status is monitored since 1 minute after power on.

*3 Ladder execution is stopped when major error occurs.

*4 Ladder execution continues when minor error occurs.

*5 In case both major error and minor error occur, major error has priority in mail sending.

For the error details of CPU unit, see "KV-5500/5000/3000 User's Manual".

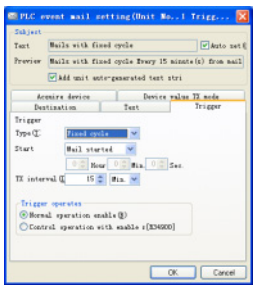
Point

Error details programmed in the error mail can be obtained from the error log of CPU unit. When trigger condition is set to "In Case of Minor Error", please set to reserve all error log in "CPU System Setting" ► "System Setting" ► "Operation Setting in Case of Error".

When "Fixed cycle" is selected

Mail send interval and trigger operation should be set.

Mail can be sent when CPU unit is in PROG/RUN mode.

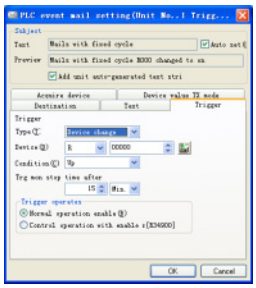


Item	Description	Default value
Start time	Mail started/specified time In case of specify time, specify the time. H (0 to 23), min (0 to 59), s (0 to 59)	Mail started
TX interval (value)	1 to 24 (h) 1 to 1440 (min) 15 to 3600 (s)	15
TX interval (unit)	H/min/s	Min
Trigger operates	• Normal operation enable • Control operation with enable relay	Normal operation enable

When "Device change" is selected

The device to be detected and detection conditions should be set.

Mail can be sent only when CPU unit is in RUN mode.



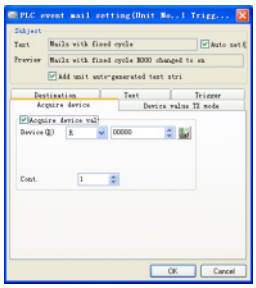
Item	Description	Default value
Device *1	To set up the device to be detected.	R00000
Condition	↑/↓/↑/↓	↑
Trigger monitor stop time after sending (value) *2	1 to 24 (h) 1 to 1440 (min) 15 to 3600 (s)	15
Trigger monitor stop time after sending (unit) *2	H/min/s	Min
Trigger operates	• Normal operation enable • Control operation with enable relay	Normal operation enable

*1 Devices that can be set to trigger are only limited to relay (R), link relay (B), internal auxiliary relay (MR), latch relay (LR), and control relay (CR).

*2 According to the setting of trigger monitor stop time after sending , no mail will be sent in certain time after mail has been sent.

■ Acquire device

Set the device to be acquired when trigger occurs.



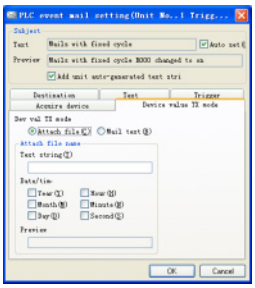
Item	Description
Acquire device value	If checked, the value of device already set is acquired when trigger occurs. It is available only when trigger type is set to "Fixed period" or "Device change".
Device	To set up leading device of the devices to be acquired.
Cont number	To set up the number of consecutive devices to be acquired.

■ Device value send mode

Set the method to send the acquired device value.

Select device value send mode as "Attachment" or "Mail text".

If "Attachment" is selected, the attachment name should be set.



Item	Description
Text string	To set up the attachment name. Up to 16 half-width characters can be set.
Date/time	To select date and time (Y, M, D, H, M, S) to be added to the attachment name.
Preview	To preview the attachment name.

Mail Send Example

■ Trigger type: PLC status change Trigger content: minor error

Title

PLC status change PLC minor error #128 Ladder operation

Text

Sender: monitor unit
CPU model: KV-5000 EtherNet/IP Device model: KV-EP21V
IP address: 192.168.0.10
Trigger detection date and time: 2010/06/14 15:23:49
PLC mode: PROG mode
PLC error status: minor error
Error content: #128 Ladder operation
Error occurrence date and time: 2010/06/14 15:23:48
Module name: Ladder TEST
Step No.: 11
Detailed information: divide by 0

■ Trigger type: fixed cycle Trigger content: every one hour from mail operation start

Title

Fixed period mail Every one hour from mail operation start

Text

Sender: monitor unit
CPU model: KV-5000 EtherNet/IP Device model: KV-EP21V
IP address: 192.168.0.10
Trigger detection date and time: 2010/06/14 21:35:31
Acquire water level data in consecutive 1 device from DM02000.
12000

■ Trigger type: device change Trigger content: at the rising edge of R10000

Title

Device change Water level warning R10000 is ON.

Text

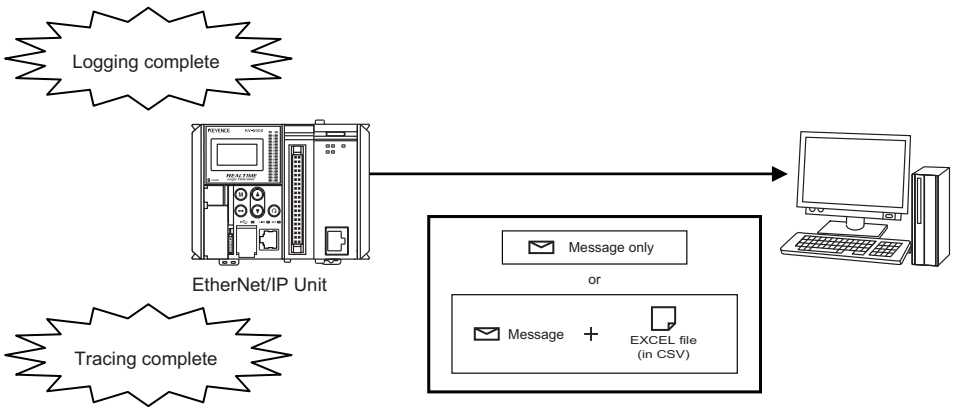
Sender: monitor unit
CPU model: KV-5000 EtherNet/IP Device model: KV-EP21V
IP address: 192.168.0.10
Trigger detection date and time: 2010/06/14 11:35:32
Water level warning R10000 is ON.
Acquire value of consecutive 4 devices from DM01000.
28797,44735,30287,13159

10-4 Logging/Tracing Mail Sending

This section describes logging/tracing mail sending.

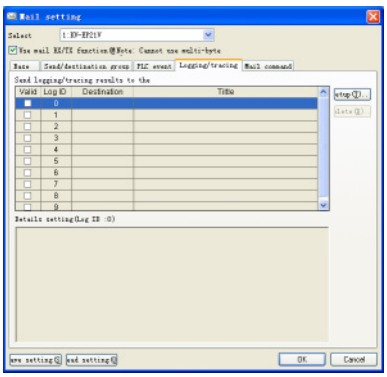
Overview of Logging/Tracing Mail Sending

Whether logging/tracing file is generated is checked every one second. Mail will be sent if file is generated. Logging/tracing result file can be attached to the mail.
If there are multiple logging/tracing result files, the latest result file will be attached for sending.
For the details of logging/tracing function, see 🕮 "KV-5500/5000/3000 User's Manual", or 🕮 "KV Nano Series User's Manual".



Logging/Tracing

Logging/tracing mail sending can be set in this tab.
Up to 10 can be set.

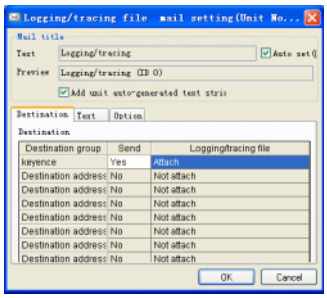


Item	Description
Valid	If checked, the selected log ID is valid. If log ID is not set, double click to display logging/tracing mail settings dialog box.
Setup	Press "Setting" button to display logging/tracing mail settings dialog box. The selected log ID can be set.
Delete	Press "Delete" button to delete the setting of selected ID.

"Startup of Mail Setting Tool", page 10-5

Logging/tracing file mail settings dialog box

Details of logging/tracing mail can be set in this dialog box.



Item	Description
Text	To set up character string displayed in the title. Up to 64 half-width characters can be set.
Preview	To preview title.
Auto set	If checked, the title is set automatically.
Add unit auto-generated text string	If checked, logging/tracing ID No. is attached automatically.

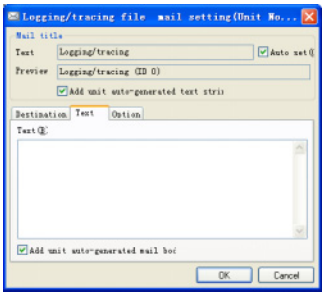
■ Receiver

Select the receiver group to send mail.

In addition, select whether to attach logging/tracing result file.

■ Text

Set the content to be written by the user in mail text.

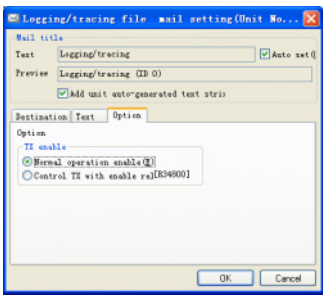


Item	Description
Text	To set up text content. Up to 256 half-width characters can be set.
Add unit auto-generated mail body	If checked, content of PLC event is attached automatically.

■ Options

Select logging/tracing mail sending control from the following options.

- Normal operation enable
- Control TX with enable relay



Mail Send Example

■ Example of mail sent at logging complete of ID5

Title

Logging/tracing ID5

Text

Sender: monitor unit
CPU model: KV-5000 EtherNet/IP Device model: KV-EP21V
IP address: 192.168.0.10
Logging/tracing ID: 5
Saving date and time of the logging/tracing file: 2010/06/14 15:23:00

* Logging/tracing result can be attached to the file for sending.

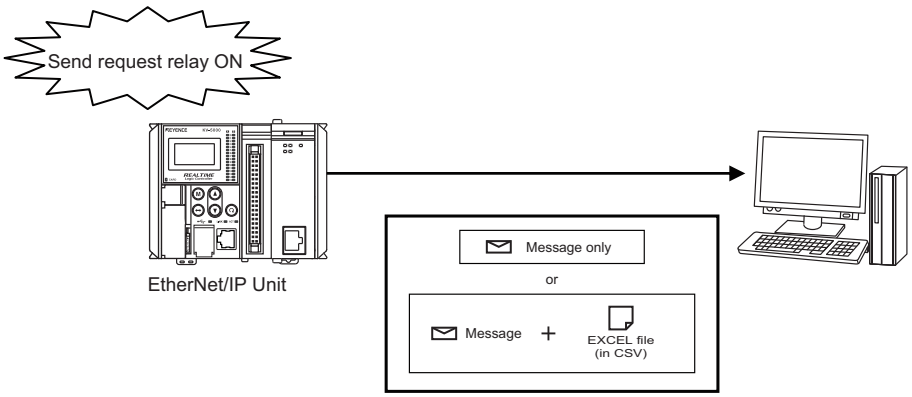
10-5 Mail Sending Based on Ladder

This section describes mail sending based on Ladder.

Overview of Mail Sending Based on Ladder

Unit-specific command in ladder program is used to write the mail content in the buffer memory, and then mail send request relay is set to ON to send mail.

"Unit-specific Command for Mail Send", page 10-23



Mail Content Setting Method

■ Receiver

- **When sending to the receiver group that is set using "Mail Setting" tool**

Unit-specific command U_MLTOGR is used to write receiver group ID in the buffer memory.

- **When sending mail by specifying receiver address with Ladder**

Unit-specific command U_MLTOGR is used to write 65535 (decimal) in receiver group ID area of buffer memory , and unit-specific command U_MLTO is used to write receiver address.

"," is used to send mail to multiple addresses.

The receiver address, including ",", may contain up to 256 half-width characters.

■ Title

Unit-specific command U_MLSUB is used to write title in the buffer memory.

Up to 256 half-width characters can be set for the title.

■ Text

Unit-specific command U_MLTEXT is used to write text in the buffer memory.

Up to 2000 half-width characters can be set for the text.

■ Attachment path

Unit-specific command U_MLATTA is used to write the path of attachment in memory card. When specifying attachment path, "/CARD/" (half-width, uppercase) should be added before the root of absolute path (full path).

For attachment path, up to 254 half-width characters can be set, including directory name and file name.

If there is no attachment, write "0".

The Device Used in the Mail Send/Receive Function

Relays and buffer memories used in mail send/receive function are as follows.

■ Relay

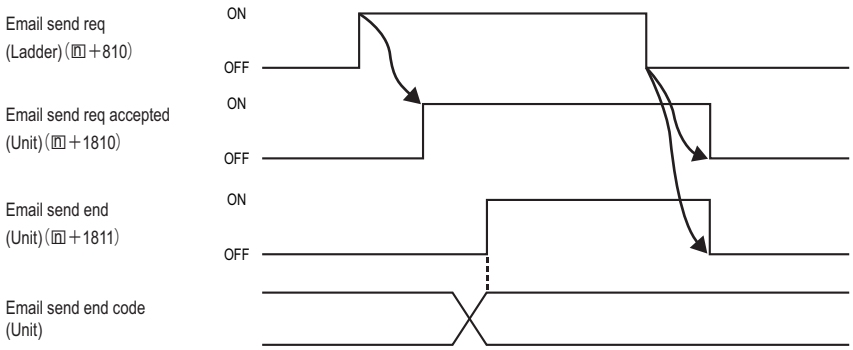
n: Leading relay No.

Relay No.	Name	Function	R/W
n+800	Log/trace email enable ID0	Enable to send logging/tracing mail.	W
n+801 to 809	Log/trace email enable ID1 to 9		
n+810	Email send req	Execute mail sending at rising edge.	W
n+811 to 815	Reserved for system	Unavailable	-
n+900	PLC event email enable ID0	Enable to send PLC event mail.	W
n+901 to 915	PLC event email enable ID1 to 15		
n+1800 to 1809	Reserved for system	Unavailable	-
n+1810	Email send req accepted	It is ON after mail send request is accepted.	R
n+1811	Email send end	It is ON after mail sending is completed.	R
n+1812	Email send fail	It is ON after mail sending fails.	R
n+1813	Email receive/send enable	It is ON when mail send/receive is available.	R
n+1814	Device trigger detect enable	It is ON when device trigger detection is available.	R
n+1815	Reserved for system	Unavailable	-

■ Buffer memory

Address	Name	Function	R/W
#20	Email receiver group No.	Store receiver group No.	W
#21	Email receiver address size	Store receiver address size.	W
#22 to 150	Email receiver address	Store receiver address.	W
#151	Email send title size	Store send title size.	W
#152 to 280	Email send title	Store send title.	W
#281	Email send body size	Store mail text size.	W
#282 to 1282	Email send body	Store mail text.	W
#1283	Email send attachment name size	Store size of the send attachment name.	W
#1284 to 1412	Email send attachment name	Store the send attachment name.	W
#1413	Email send end code	Store the value after mail sending.	R
#1414 to 1419	Reserved for system	Unavailable	-

Mail Send Procedure



(1) Unit-specific command is used to store receiver group ID, title, text, and attachment path in the buffer memory. (If receiver address is specified, receiver address is also stored.)
(2) Email send req relay (n+810) is set to ON.
(3) When the EtherNet/IP Unit accepts an email send request, email send req accepted relay (n+1810) changes to ON.
(4) After email sending is completed, email send end relay (n+1811) will be ON.
(5) After email send end relay ON is checked, email send req relay is set to OFF.
(6) When the EtherNet/IP Unit detects a falling edge of email send req relay, the email send end relay and email send accepted relay changes to OFF.
(7) If email send fail relay (n+1812) is OFF, email sending is completed; if ON, unit-specific command U_MLSTAT is used to read email send end code from the buffer memory, and error is processed.

Precautions for mail sending based on ladder

Before email send req accepted relay is ON, if email send req relay is set to OFF, email sending may not be executed.

During the period from email send req accepted relay ON to email send end relay ON, if email send req relay is set to OFF, email sending continues.

Mail Send Complete Code List

With U_MLSTAT command, mail send complete code can be read from the buffer memory.
Mail send complete code is as follows.
If mail sending is completed normally, mail send complete code is stored as "0".

Code	Description	Cause	Measures
0	Normal	-	-
91	POP3 connection error	Address resolution or connection of POP server failure.	Please check whether there is any exception in the DNS server address setting, and network path status. Please check whether IP address of POP server is correct.
92	POP3 authentication error	Error occurs during POP3 authentication.	Please check whether there is any exception in POP server status, and network path status. Please check whether account setting for POP authentication is correct or not.
93	SMTP connection error	Address resolution or connection of SMTP server failure.	Please check whether there is any exception in the DNS server address setting, and network path status. Please check whether IP address of SMTP server is correct.
94	SMTP authentication error	Error occurs during SMTP authentication.	Please check whether there is any exception in the SMTP server status, and network path status. Please check whether account setting for SMTP authentication is correct.
95	SMTP communication error	Error occurs during the communication with SMTP.	Please check whether there is any exception in SMTP server status, and network path status.
101	Text send error	Error occurs during mail text sending.	Please check whether there is any exception in the server status, and network path status.
102	Restriction on mail size to send	Beyond send mail size restriction.	Please adjust the setting of size restriction for mail to be sent. Please check attachment size.
110	Mail send acceptance overflow	Mail send request overflow.	With respect to mail sending speed, too frequent mail send trigger times. Please adjust frequency of occurrence for PLC event mail, logging/tracing mail, mail based on ladder etc. In case mail could not be sent, please do not continue to generate mail trigger.
111	Send address setting error	Sender address is abnormal.	Please check whether the address exists, whether special characters are included, whether the mail address exists.
112	Send group setting error	Receiver group setting of Ladder mail is abnormal.	Please set receiver group as 0 to 7 or set to 65535.
113	CPU unit communication error	Try to execute communication in case communication with CPU unit is unavailable.	When setting is just transferred to CPU unit, communication is unavailable. Mail send function cannot work. When expansion bus communication error occurs, please restart the system.
114	File access error	There is no CARD, CARD is removed during file accessing, file does not exist.	Please insert the card, and execute again. Please do not specify nonexistent file.
300	Not assign IP address.	IP address has not been assigned.	Please check the setting of "IP address setting method". Please check if there is any exception in BOOTP server setting or communication path.

10-6 Unit-specific Command for Mail Send

This section describes unit-specific commands for mail send in Ladder program. For command used in script program, see "10-7 Unit-specific Function for Mail Send", page 10-36.

Unit-specific Command List

Function	Command	Command description	Page
Mail receiver group setting	U_MLTOGR	Write ID No. of the receiver group to send mail in the buffer memory.	10-24
Mail receiver address setting	U_MLTO	Write receiver address to send mail in the buffer memory.	10-26
Mail title setting	U_MLSUB	Write the title of mail to be sent in the buffer memory.	10-28
Mail text setting	U_MLTEXT	Write mail text in the buffer memory.	10-30
Mail attachment name setting	U_MLATTA	Write the path of file attached to the sent mail in the buffer memory.	10-32
Acquire mail send result	U_MLSTAT	Read mail send complete code from the buffer memory.	10-34

U_MLTOGR

@U_MLTOGR

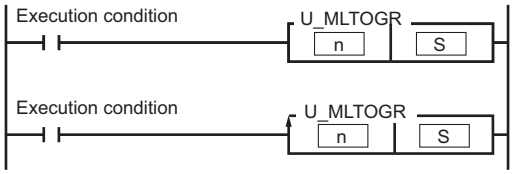




Mail receiver group setting

Write the receiver group No. to send mail in the buffer memory.

Ladder program



Input method





Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
S	○	-	○	-	-	-		○	○*2	○	○	-	-	-		-	-	○	○	○

Operand	Description
n	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
S	Specify receiver group No. (0 to 7) or the device to store it. *1

*1 If bit device is specified for S, consecutive 16 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

*2 EM, FM and ZF cannot be used with the KV Nano Series.

Operation

U_MLTOGR If execution condition is ON, write the value specified by S in the buffer memory of No. n unit as receiver group No. to send mail.

	Device No.		Buffer memory address
Receiver group No.	S	→	#20

When sending mail to the address specified by U_MLTO command, but not to the address set for the receiver group, command U_MLTOGR is executed by setting S to 65535 (decimal), or specifying the storage device.

@U_MLTOGR Execute single scan only at the rising edge of execution condition.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON when any of the following conditions is satisfied, otherwise, it is OFF. • The unit No. specified by [n] is out of range. • The unit with the unit No. specified by [n] is not KV-5500, KV-EP21V, KV-5000, KV-LE21V, KV-LE20V or KV-NC1EP. • Indirect specifying or index modification range is inappropriate

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

Sample Program

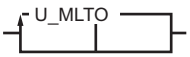
at the rising edge of MR0, write the receiver group No. to send mail in the buffer memory.



U_MLTO

@U_MLTO

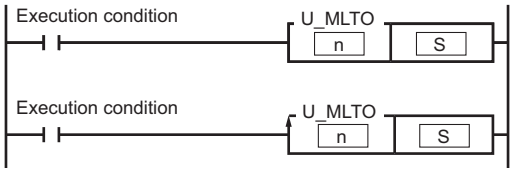




Mail receiver address setting

Write receiver address to send mail in the buffer memory.

Ladder program



Input method

U _ M L T O ␣ n ␣ S ↵

@ U _ M L T O ␣ n ␣ S ↵

Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
S	○	-	○	-	-	-	○	○	○*2	○	○	-	-	-	○	-	-	○	○	○

Operand	Description
n	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
S	Specify the device to store receiver address size (in byte) and receiver address. *1

*1 If bit device is specified for S, consecutive 16 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

*2 EM, FM and ZF cannot be used with the KV Nano Series.

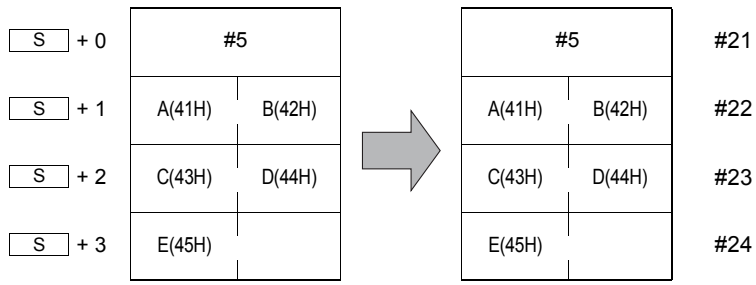
Operation

U_MLTO

If execution condition is ON, write S bytes of data stored in devices starting from S +1 in turn in the buffer memory of No. n unit as receiver address to send mail.

	Device No.		Buffer memory address
Receiver address size (in byte)	S	+ 0	#21
Address	S	+ 1 to	#22 to

(Example) write 5-byte receiver address



10

MAIL SEND/RECEIVE

When specifying receiver address with U_MLTO command to send mail, it is necessary to store 65535 (decimal) in the receiver group No. with U_MLTOGR command in advance.

@U_MLTO At the rising edge of execution condition, only single scan is executed.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON when any of the following conditions is satisfied, otherwise, it is OFF. • The unit No. specified by n is out of range. • The unit with the unit No. specified with n is not KV-5500, KV-EP21V, KV-5000, KV-LE21V, KV-LE20V or KV-NC1EP. • The value stored in the device specified by S is above 257 • Starting from the next No. of the device specified by S, number of bytes of device stored in S cannot be ensured • Indirect specifying or index modification range is inappropriate

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

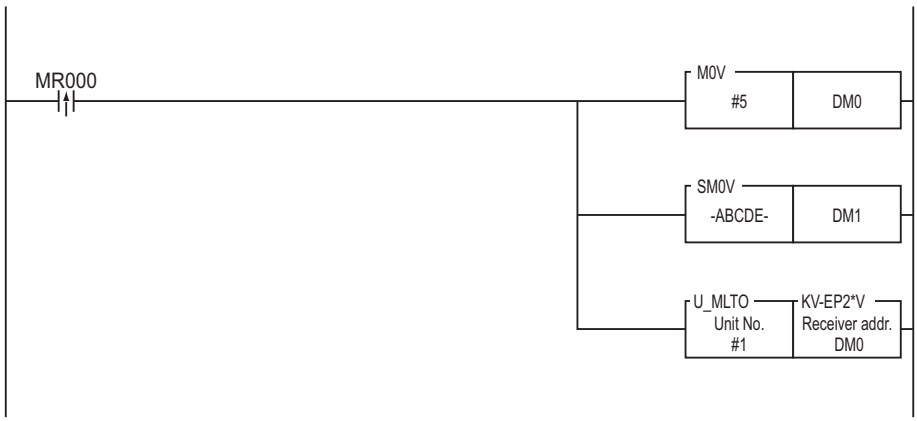
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

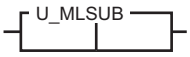
Sample Program

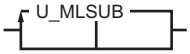
At the rising edge of MR0, write 5-byte receiver address, which is stored in devices starting from DM1 in the unit of byte, in the buffer memory.



U_MLSUB

@U_MLSUB

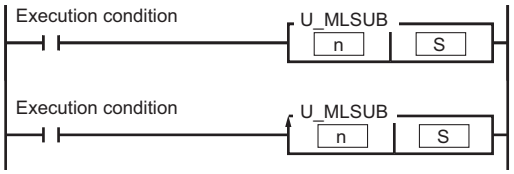




Mail title setting

Write the title of mail to be sent in the buffer memory.

Ladder program



Input method

U_MLSUB n S ↵

@U_MLSUB n S ↵

Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
S	○	-	○	-	-	-	○	○	○*2	○	○	-	-	-	○	-	-	○	○	○

Operand	Description
n	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
S	Specify the device to store title size (in byte) and title. *1

*1 If bit device is specified for S, consecutive 16 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

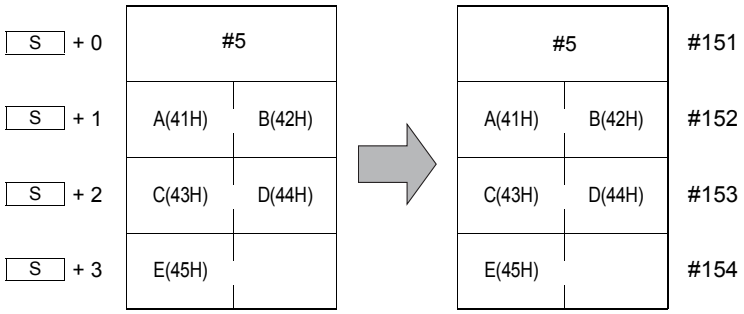
*2 EM, FM and ZF cannot be used with the KV Nano Series.

Operation

U_MLSUB If execution condition is ON, write S bytes of data stored in devices starting from S + 1 in turn in the buffer memory of No. n unit as mail title.

	Device No.		Buffer memory address
Title size (in byte)	S + 0	→	#151
Title	S + 1 to		#152 to

(Example) write 5-byte title



@U_MLSUB At the rising edge of execution condition, only single scan is executed.

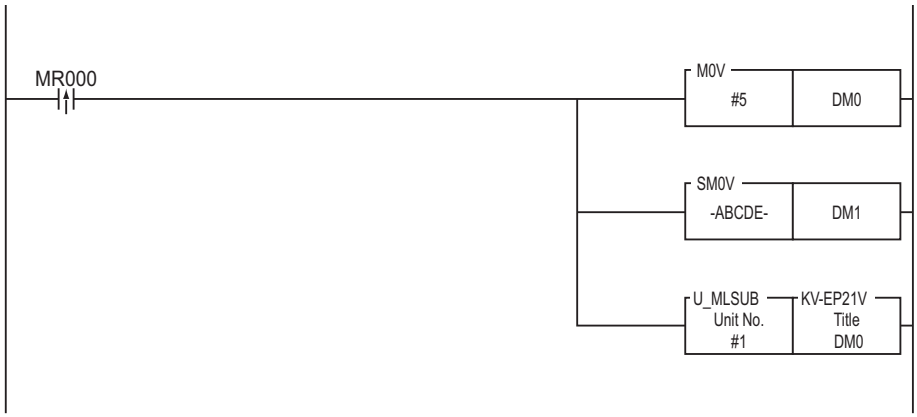
Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON when any of the following conditions is satisfied, otherwise, it is OFF. • The unit No. specified by [n] is out of range. • The unit with the unit No. specified with [n] is not KV-5500, KV-EP21V, KV-5000, KV-LE21V, KV-LE20V or KV-NC1EP. • The value stored in the device specified by [S] is above 257 • Starting from the next No. of the device specified by [S], number of bytes of device stored in [S] cannot be ensured • Indirect specifying or index modification range is inappropriate

* If CR2012 is ON, command is not executed.
KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.
"KV-5500/5000/3000 User's Manual"
"KV Nano Series User's Manual"

Sample Program

At the rising edge of MR0, write 5-byte title, which is stored in devices starting from DM1 in the unit of byte, in the buffer memory.



U_MLTEXT

@U_MLTEXT

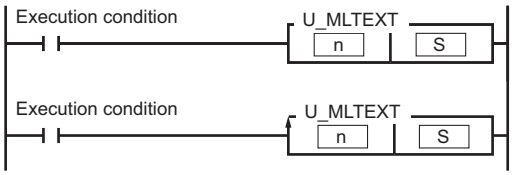




Mail text setting

Write mail text in the buffer memory.

Ladder program



Input method





Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
S	○	-	○	-	-	-	○	○	○*2	○	○	-	-	-	○	-	-	○	○	○

Operand	Description
n	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
S	Specify the device to store text size (in byte) and text. *1

*1 If bit device is specified for S, consecutive 16 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

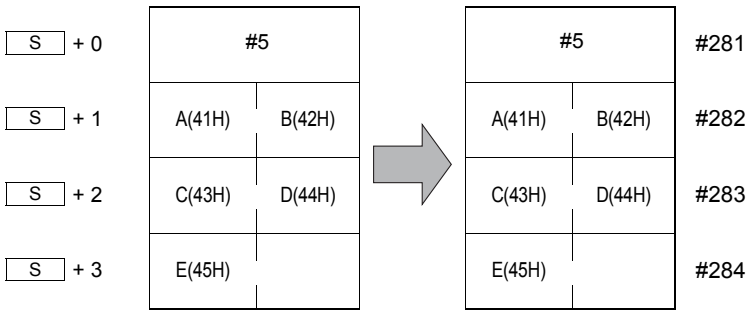
*2 EM, FM and ZF cannot be used with the KV Nano Series.

Operation

U_MLTEXT If execution condition is ON, write S bytes of data stored in devices starting from S + 1 in turn in the buffer memory of No. n unit as mail text.

	Device No.		Buffer memory address
Text size (in byte)	S + 0	→	#281
Text	S + 1 to	→	#282 to

(Example) write 5-byte text



@U_MLTEXT At the rising edge of execution condition, only single scan is executed.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON when any of the following conditions is satisfied, otherwise, it is OFF. • The unit No. specified by [n] is out of range. • The unit with the unit No. specified by [n] is not KV-5500, KV-EP21V, KV-5000, KV-LE21V, KV-LE20V or KV-NC1EP. • The value stored in the device specified by [S] is above 2001 • Starting from the next No. of the device specified by [S], number of bytes of device stored in [S] cannot be ensured • Indirect specifying or index modification range is inappropriate

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

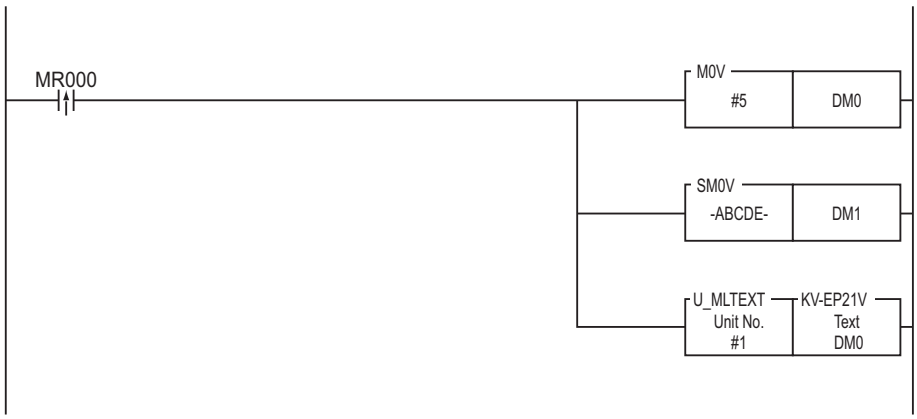
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

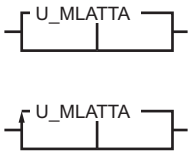
Sample Program

At the rising edge of MR0, write 5-byte text, which is stored in devices starting from DM1 in the unit of byte, in the buffer memory.



U_MLATTA

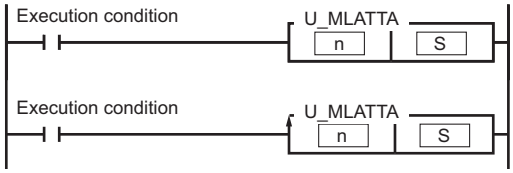
@U_MLATTA



Mail attachment name setting

Write the path of file attached to the sent mail in the buffer memory.

Ladder program



Input method



Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
S	○	-	○	-	-	-	○	○	○*2	○	○	-	-	-	○	-	-	○	○	○

Operand	Description
n	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
S	Specify the device to store attachment name size (in byte) and attachment name. *1

*1 If bit device is specified for S, consecutive 16 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

*2 EM, FM and ZF cannot be used with the KV Nano Series.

Operation

U_MLATTA If execution condition is ON, write S bytes of data stored in devices starting from S + 1 in turn in buffer memory of No. n unit as attachment name for mail sending. When specifying attachment name, "/CARD/" (half-width, uppercase) should be added before the root of absolute path (full path).

	Device No.	Buffer memory address
Size of the attachment name (in byte)	S + 0	#1283
Attachment name	S + 1 to	#1284 to

(Example) attach "abc" file in root folder of the memory card.

S + 0	#9		#9		#1283
S + 1	/(2FH)	C(43H)	/(2FH)	C(43H)	#1284
S + 2	A(41H)	R(52H)	A(41H)	R(52H)	#1285
S + 3	D(44H)	/(2FH)	D(44H)	/(2FH)	#1286
S + 4	a(61H)	b(62H)	a(61H)	b(62H)	#1287
S + 5	c(63H)		c(63H)		#1288

@U_MLATTA At the rising edge of execution condition, only single scan is executed.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON when any of the following conditions is satisfied, otherwise, it is OFF. • The unit No. specified by [n] is out of range. • The unit with the unit No. specified by [n] is not KV-5500, KV-EP21V, KV-5000, KV-LE21V, KV-LE20V or KV-NC1EP. • The value stored in the device specified by [S] is above 255 • Starting from the next No. of the device specified by [S], number of bytes of device stored in [S] cannot be ensured • Indirect specifying or index modification range is inappropriate

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

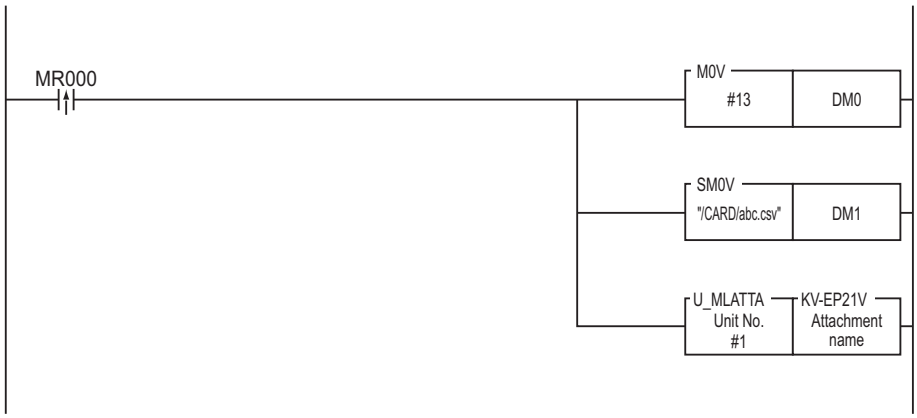
"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

Sample Program

"abc.csv" in root folder of the memory card is attached.

At the rising edge of MRO, write the attachment name with "/CARD/" at the beginning, which is stored in devices starting from DM1, in the buffer memory.



U_MLSTAT



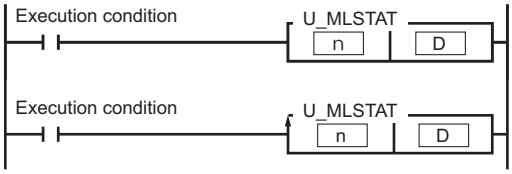
@U_MLSTAT



Acquire mail send result

Read mail send complete code from the buffer memory.

Ladder program



Input method





Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-	-
D	○	-	○	-	-	-	○	○	○*2	○	○	-	-	-	○	-	-	○	○	○

Operand	Description
n	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
D	Specify the device to store mail send result code. *1

*1 If bit device is specified for D, consecutive 16 bits will be processed. If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

*2 EM, FM and ZF cannot be used with the KV Nano Series.

Operation

U_MLSTAT If execution condition is ON, read mail send complete code from buffer memory of No. n unit, and store it in the device specified by D.

	Buffer memory address	Device No.
Mail send complete code	#1413	D

@U_MLSTAT At the rising edge of execution condition, only single scan is executed.

Operation flag

CR2009	No change
CR2010	No change
CR2011	No change
CR2012	It is ON when any of the following conditions is satisfied, otherwise, it is OFF. • The unit No. specified by n is out of range. • The unit with the unit No. specified by n is not KV-5500, KV-EP21V, KV-5000, KV-LE21V, KV-LE20V or KV-NC1EP. • Indirect specifying or index modification range is inappropriate

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 User's Manual"

"KV Nano Series User's Manual"

Sample Program

At the rising edge of MR0, read mail send complete code from the buffer memory, and store it in DM0.



10-7 Unit-specific Function for Mail Send

This section describes unit-specific functions for mail send in the script program is described. For command used in Ladder program, see "10-6 Unit-specific Command for Mail Send", page 10-23.

Unit-specific Function List

Function	Function	Function description	Page
Mail receiver group setting	U_MLTOGR	Write ID No. of the receiver group to send mail in the buffer memory.	10-37
Mail receiver address setting	U_MLTO	Write receiver address to send mail in the buffer memory.	10-38
Mail title setting	U_MLSUB	Write the title of mail to be sent in the buffer memory.	10-39
Mail text setting	U_MLTEXT	Write mail text in the buffer memory.	10-40
Mail attachment name setting	U_MLATTA	Write the path of file attached to the sent mail in the buffer memory.	10-41
Acquire mail send result	U_MLSTAT	Read mail send complete code from the buffer memory.	10-42

U_MLTOGR Mail receiver group setting

U_MLTOGR ([execution condition]*1, unit No., receiver group No.)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No. *2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	○
S	Receiver group No. *3	Specify receiver group No. (0 to 7) or the device to store it.	.U	.U	.U	.U	-	-	-	-	○	○	○

*1 [ ] can be omitted. (if execution condition is omitted, function is executed in each scanning.)

*2 $ (Specify hex) cannot be used.

*3 If bit device is specified for n and S, consecutive 16 bits will be processed.
If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

Operation

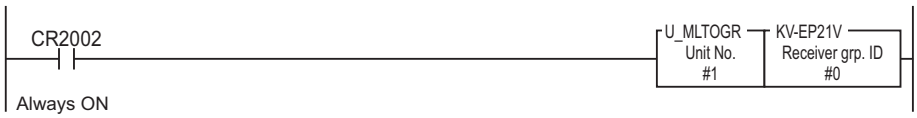
Write the value specified by S in the the buffer memory of No. n unit as receiver group No. to send mail.

	Device No.		Buffer memory address
Receiver group No.	S		#20

When sending mail to the address specified by U_MLTO command, but not to the address set for the receiver group, command U_MLTOGR is executed by setting S to 65535 (decimal), or specifying the storage device.

● Format example

U_MLTOGR (1,1)



U_MLTO Mail receiver address setting

U_MLTO ([execution condition]*1, unit No., leading device)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No. *2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	○
S	Leading device *3	Specify the device to store receiver address size (in byte) and receiver address.	.U	.U	.U	.U	-	-	-	-	-	○	-

*1 [ ] can be omitted. (if execution condition is omitted, function is executed in each scanning.)

*2 $ (Specify hex) cannot be used.

*3 If bit device is specified for n and S, consecutive 16 bits will be processed.
If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

Operation

Write S bytes of data stored in devices starting from S + 1 in turn in the buffer memory of No. n unit as receiver address to send mail. Up to 256 bytes of data can be written.

	Device No.		Buffer memory address
Receiver address size (in byte)	S + 0	→	#21
Address	S + 1 to	→	#22 to

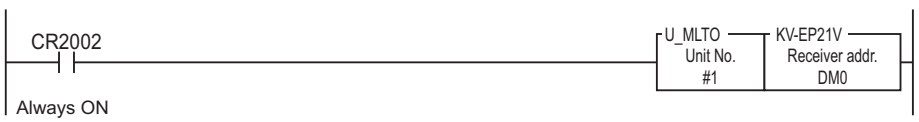
(Example) write 5-byte receiver address

S + 0	#5		→	#5		#21
S + 1	A(41H)	B(42H)	→	A(41H)	B(42H)	#22
S + 2	C(43H)	D(44H)	→	C(43H)	D(44H)	#23
S + 3	E(45H)		→	E(45H)		#24

* When specifying receiver address with U_MLTO command to send mail, it is necessary to store 65535 (decimal) in the receiver group No. with U_MLTOGR command in advance.

● Format example

U_MLTO(1, DM0)



U_MLSUB Mail title setting

U_MLSUB ([execution condition]*1, unit No., leading device)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No. *2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	○
S	Leading device *3	Specify the device to store title size (in byte) and title.	.U	.U	.U	.U	-	-	-	-	-	○	-

*1 [ ] can be omitted. (if execution condition is omitted, function is executed in each scanning.)

*2 $ (Specify hex) cannot be used.

*3 If bit device is specified for n and S, consecutive 16 bits will be processed.
If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

Operation

Write S bytes of data stored in devices starting from S + 1 in turn in the buffer memory of No. n unit as mail title. Up to 256 bytes of data can be written.

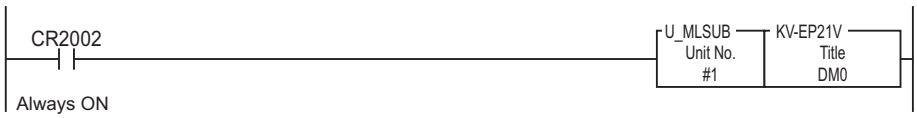
	Device No.		Buffer memory address
Title size (in byte)	S + 0	→	#151
Title	S + 1 to	→	#152 to

(Example) write 5-byte title

S + 0	#5		→	#5		#151
S + 1	A(41H)	B(42H)	→	A(41H)	B(42H)	#152
S + 2	C(43H)	D(44H)	→	C(43H)	D(44H)	#153
S + 3	E(45H)		→	E(45H)		#154

- **Format example**

U_MLSUB(1, DM0)



U_MLTEXT Mail text setting

U_MLTEXT ([execution condition]*1, unit No., leading device)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No. *2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	○
S	Leading device *3	Specify the device to store text size (in byte) and text.	.U	.U	.U	.U	-	-	-	-	-	○	-

*1 [ ] can be omitted. (if execution condition is omitted, function is executed in each scanning.)

*2 $ (Specify hex) cannot be used.

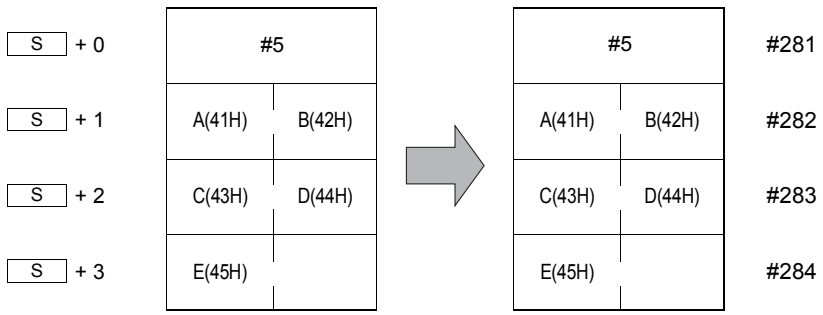
*3 If bit device is specified for n and S, consecutive 16 bits will be processed.
If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

Operation

Write S bytes of data stored in devices starting from S + 1 in turn in the buffer memory of No. n unit as mail text. Up to 2000 bytes of data can be written.

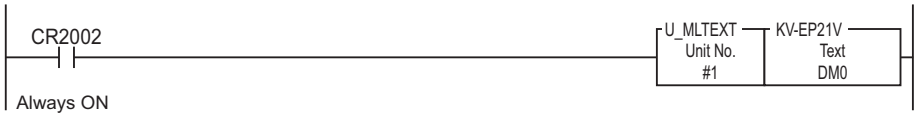
	Device No.		Buffer memory address
Text size (in byte)	S + 0	→	#281
Text	S + 1 to	→	#282 to

(Example) write 5-byte text



- **Format example**

U_MLTEXT(1, DM0)



U_MLATTA Mail attachment name setting

U_MLATTA ([execution condition]*1, unit No., leading device)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No. *2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	○
S	Leading device *3	Specify the device to store attachment name size (in byte) and attachment name.	.U	.U	.U	.U	-	-	-	-	-	○	-

*1 [ ] can be omitted. (if execution condition is omitted, function is executed in each scanning.)

*2 $ (Specify hex) cannot be used.

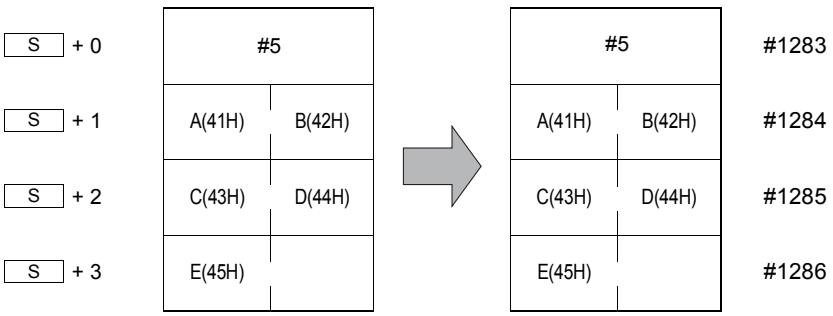
*3 If bit device is specified for n and S, consecutive 16 bits will be processed.
If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

Operation

Write S bytes of data store from S + 1 in turn in buffer memory of No. n unit as attachment name. Up to 254 bytes of data can be written.
When specifying attachment name, "/CARD/" (half-width, uppercase) should be added before the root of absolute path (full path).

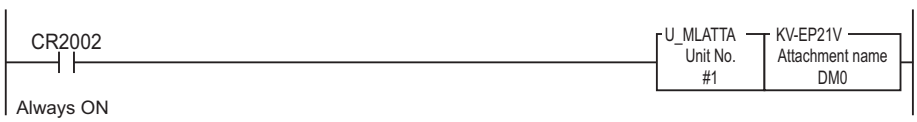
	Device No.		Buffer memory address
Size of attachment name (in byte)	S + 0	⇒	#1283
Attachment name	S + 1 to		#1284 to

(Example) write 5-byte attachment name



- **Format example**

U_MLATTA(1, DM0)



U_MLSTAT Acquire mail send result

U_MLSTAT ([execution condition]*1, unit No., leading device)

Argument/return value		Description	Type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n	Unit No. *2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	○
D	Leading device *3	Specify the device to store mail send result code.	.U	.U	.U	.U	-	-	-	-	○	○	○

*1 [ ] can be omitted. (if execution condition is omitted, function is executed in each scanning.)

*2 $ (Specify hex) cannot be used.

*3 If bit device is specified for n and D, consecutive 16 bits will be processed.
If any device (R002, R1012 etc) other than the leading one of the channel is specified, 16 bits will be processed by crossing over to the next channel.

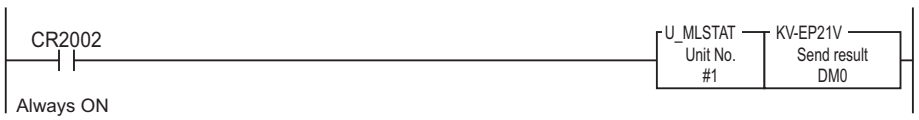
Operation

Read mail send complete code from the buffer memory of No. n unit, and store it in the device specified by D.

	Buffer memory address		Device No.
Mail send complete code	#1413	→	D

- **Format example**

U_MLSTAT(1, DM0)



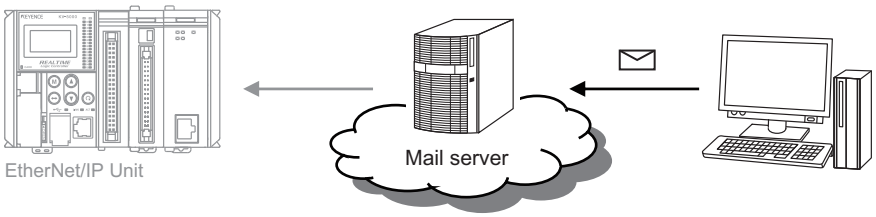
10-8 Mail Command Receiving

This section describes mail command receiving function.

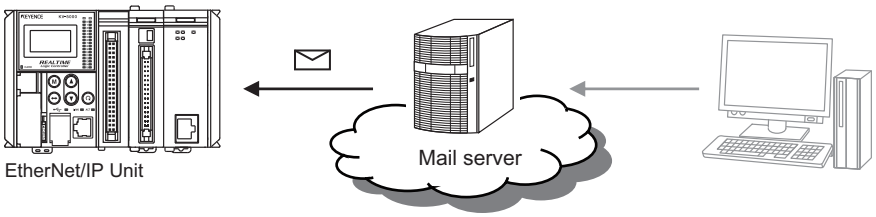
Overview of Mail Command Receiving Function

With mail command receiving function, certain host-link commands and mail-specific commands can be executed and the result can be returned by the EtherNet/IP Unit receiving mail that contains the command.
Mail command receiving function can be used as follows.

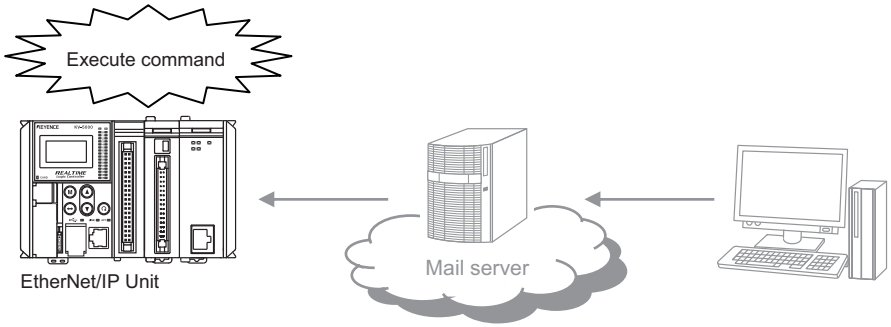
(1) Send mail programmed with the command to the EtherNet/IP Unit. Commands can be programmed easily using Mail Command Maker.
"Mail Command Maker", page 10-49



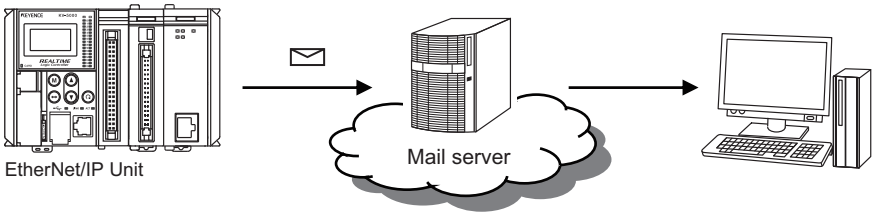
(2) The EtherNet/IP Unit accesses the POP server periodically to receive mail.
"Setting of Mail Command Receiving Function", page 10-44



(3) The EtherNet/IP Unit executes the command programmed in the mail.
"Command List", page 10-45

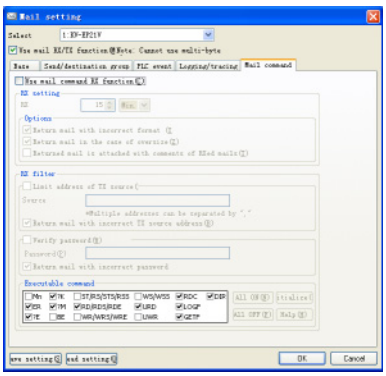


(4) The EtherNet/IP Unit returns the mail programmed with the response to the executed command.



Setting of Mail Command Receiving Function

Necessary setting for mail command receiving function is described.



Item	Description
Use mail RX/TX function *1	If checked mail command receiving function is available.
RX interval (value) *1	1 to 24 (h) 1 to 1440 (min) 15 to 3600 (s) (default value: 15)
RX interval (unit) *1	H/min/s (default value: min)
Options	Check the following options to realize various operations. • Return mail with incorrect format • Return mail in case of oversize • Returned mail is attached with of RXed mails
Limit address of TX source	When receiving mail only from specific address, check "Limit address of TX source" to program sender address to be received. Multiple sender addresses can be specified using "," for separation. If "Return mail with incorrect TX source address" is checked, when mail is received from any address other than the selected address, mail can be returned.
Verify password	When password is used to verify the mail, check "password authentication" to program the password. Up to 32 half-width alphanumerics and the following characters can be set. "!", "#", "$", "%", "&", "'", "*", "+", "-", "/", "=", "?", "^", "_", "`", "{", "}", "|", "@" When "Return mail with incorrect password" is checked, if the password programmed in mail is inconsistent with the set password, the mail will be returned.
Executable command	Only checked command can be executed.

*1 To use mail command receiving function, these items must be set.

Command List

With the EtherNet/IP Unit mail command receiving function, not only certain higher-lever link communication function commands, but also special command for mail command receiving functions can be executed.

■ Executable command of host-link communication function

Function	Command	See page
Change mode	Mn	page 8-9
Clear error	ER	page 8-10
Check error No.	?E	page 8-10
Query model	?K	page 8-12
Check operating mode	?M	page 8-12
Forced set/forced reset	ST/RS	page 8-14
Consecutive forced set/consecutive forced reset	STS/RSS	page 8-15
Read data	RD	page 8-16
Read consecutive data	RDS/RDE	page 8-16
Write data	WR	page 8-21
Write consecutive data	WRS/WRE	page 8-23
Write set value	WS	page 8-23
Write consecutive set value	WSS	page 8-23
Read comments	RDC	page 8-28
Bank switching	BE	page 8-29
Read expansion unit buffer memory	URD	page 8-30
Write expansion unit buffer memory	UWR	page 8-31

■ Mail receiving function specific command

Function	Command	See page
Logging/tracing file acquisition	LOGF	page 10-46
File acquisition	GETF	page 10-46
Directory/file information acquisition	DIR	page 10-46

Special Command for Mail Command Receiving Function

Special command for mail command receiving function is described.

■ Logging/tracing file acquisition (LOGF)

With this command the mail attached with the latest log file of the specified ID can be replied.
When specifying attachment name, "/CARD/" (half-width, uppercase) should be added before the root of absolute path (full path).

Command

LOGF	␣	Log ID

Log ID : specify within the range of 00 to 09. (zero suppression is available)

Response

There is no response character string.
This mail is replied after attaching the log file of the specified ID.

■ File acquisition (GETF)

With this command, the mail attached with the specified file can be replied.
When specifying file path, "/CARD/" (half-width, uppercase) should be added before the root of absolute path (full path).

Command

GETF	␣	File path

(specify "abc.csv" file in "test" directory)
GETF /CARD/test/abc.csv

Response

There is no response character string.
The mail is replied after attaching the specified file.

■ Directory/file information acquisition (DIR)

If a file is specified, the mail is replied after programming file status.
If the directory is specified, the mail is replied after programming file status in the directory.
When specifying file path, "/CARD/" (half-width, uppercase) should be added before the root of absolute path (full path).
If directory/file path is not specified, root information is acquired.
SD card capacity is also programmed.

Command

DIR	␣	Directory/file path

(specify "abc.csv" file in "test" directory)
DIR /CARD/test/abc.csv

Response

The mail is replied after programming directory/file information.

Format of Command Mail

The format of the command mail received by the EtherNet/IP Unit is described.

■ Title

Any title can be set within the range of 0 to 128 half-width characters.

■ Text

<kvmail> is programmed at the beginning of the text, and </kvmail> at the end.
Command, comments, and password can be programmed by enclosing with the header and footer in the table below.

Description	Header	Footer
Command	<cmd>	</cmd>
Comments	<--	-->
Password	<pwd>	</pwd>

Precautions ON format

- If any character other than space, tab, or line feed appear before <kvmail>, error occurs.
- Up to 32 commands can be prepared.
- Case-insensitive.
- Half width space, tab, line feed, and blank line can be programmed between header and footer.

Precautions for Mail Receiving and Command Execution

Precautions for mail receiving and command execution are as follows.

■ Mail receiving

- If there are multiple mails on the mail server, 1 mail is received at one time, then command is executed, and the mail is replied . Other receiving/sending is not executed until one mail is received and finally replied. Every time the EtherNet/IP Unit is receiving one mail, connection will be cut off, therefore, if there are multiple mails on the server, a long time may be required for receiving.
- The received mail will be deleted from the server, but mail receiving log will be reserved in the CPU unit.
- If the size of all mails exceeds 250KB, the command cannot be executed.

■ Command execution

The commands are executed in the sequence programmed in the mail, finally LOGF and GETF are executed. Even if LOGF and GETF are programmed in the middle of the mail, LOGF and GETF will be executed at last.

Reply Mail

The reply mail of the EtherNet/IP Unit to the received mail is described.

■ Reply destination mail address

When mail client software that has sent mail is used to specify the reply destination, mail is replied to the specified reply destination. If not specified, mail is replied to the mail sending address.

■ Title

"Re:" is added before the title of received mail.

■ Text

Command execution result and comments are programmed in the sequence programmed in the received mail.

Reply Mail in case of Error

When mail command receiving function is used, text of the reply mail in case of error is as follows.

■ Japanese

Description	Mail text
Format error	行n エラー:フォーマットが不正です。コマンドを実行しませんでした。
Password error	パスワードが不正です。正しいパスワードを記述してください。
Command quantity exception	行n エラー:コマンド数の上限を超えています。1通のメールのコマンド数の上限は32個です。
Mail receiving size exception	受信メールのサイズが上限を超えています。コマンドメールのサイズを減らしてください。
Sender address exception	許可されていないアドレスからのメールを受信しました。コマンドを実行しませんでした。
Memory card access exception	メモリカードアクセス中にエラーが発生しました。

* n : line No.

■ English

Description	Mail text
Format error	Line n error: Format is invalid. Failed in command execution.
Password error	Password is invalid. Enter correct password.
Command quantity exception	Line n error: Command quantity upper limit is exceeded. Allowable number of commands per mail is 32.
Mail receiving size exception	Received mail exceeds upper size limit. Reduce the mail size.
Sender address exception	Mail is received from unacceptable address. Failed in command execution.
Memory card access exception	Error occurred during access to memory card.

* n : line No.

10-9 Mail Command Maker

This section describes Mail Command Maker.

Overview of Mail Command Maker

Mail Command Maker is a tool used to create command mail easily. Following the displayed wizard to create command mail text. The created command mail text can be copied to clipboard, then pasted to send mail, or output to the default mail client software.

Startup of Mail Command Maker

Mail Command Maker can be started from KV STUDIO using any of the following methods.

- Select "Tool "▶" Mail Command Maker" from the menu in turn
- Click  button
- Select "Relevant Software "▶" Mail Command Maker" in the workspace
- In the unit configuration of workspace, select "Mail Command Maker" from the EtherNet/IP Unit right-click menu

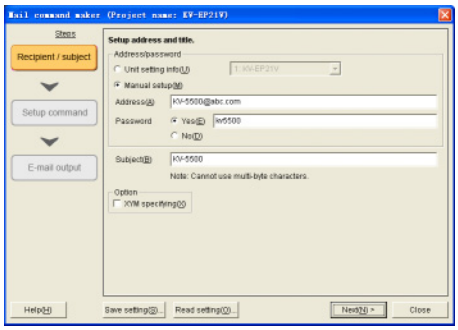
Use Mail Command Maker to Create Command Mail

With Mail Command Maker, command mail can be created following the steps below.

1. Recipient/subject

Set mail receiver and title.

At the same time, password programming and specifying by XYM expression or not can be selected.

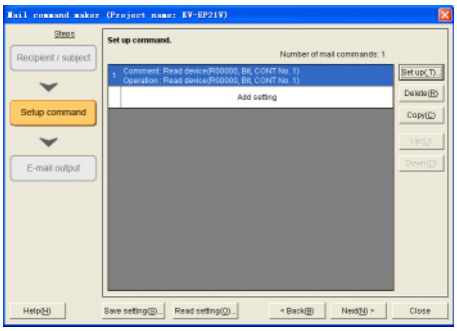


2.Setup command

Set the command to be executed. Comments can also be programmed.

Command setting No. is 1 to 50.

Up to 32 commands can be set.

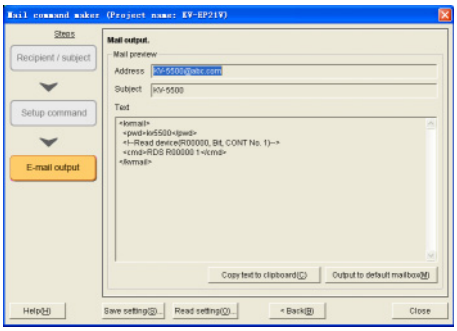


3.E-mail output

Display the commands programmed in the mail.

Click "copy text to clipboard", the data in command mail text are copied to the clipboard, therefore, it is sent after pasting to text of the new mail.

Click "output to default mailbox", the default Mailer starts, and data in receiver, title, and text of the command mail are copied to the new mail.



11

FTP SERVER

This chapter describes, using FTP, how to get device value of CPU unit, how to read/write memory card, how to operate/stop CPU unit, and how to operate access window.

11-1 FTP Server 11-2
11-2 FTP Server Function of EtherNet/IP Units. 11-5
11-3 FTP Operation with Internet Explorer 11-21
11-4 FTP Operation Based on Command Prompt 11-24
11-5 FTP Command List. 11-28

11-1 FTP Server

This section briefly describes the EtherNet/IP Unit FTP server function and the FTP operating principles.

FTP Overview of FTP Server Function

FTP server function allows to read/write data to memory card of CPU unit, and read device values in CPU unit over the network.
FTP server can be simply operated either by executing FTP commands from the command prompt or by using FTP client software.
FTP server can be used to achieve the following:

(1) Read device value of CPU unit
By connecting to the network, device value of CPU unit can be read by file even on a PC not installed with KV STUDIO. Device value of CPU unit can be acquired in CSV format by referencing this file.

(2) Acquisition of log file
Up till now, to read log data stored in a memory card, you had to remove the memory card from the CPU unit, and use a memory card reader or card adapter to load the data to a PC. FTP frees you from this trouble, and allows you to acquire log data over the network easily.

(3) RUN mode/PROGRAM mode switching of CPU unit
You can start/stop CPU unit operation by accessing (reading) specific file in the memory card.

(4) Program maintenance/changeover
FTP enables to transfer files stored in local drive of PC to the memory card of CPU unit.
After transferring Ladder program file to RUNLOAD folder of the memory card, Ladder program and device value can be changed by switching CPU unit from PROG->RUN.
If the Ladder program file is transferred to the AUTOLOAD folder of the memory card, you can change the ladder program or device values just by turning the CPU unit ON again.

FTP Specification of EtherNet/IP Units

■ User name and password

FTP works on the basis of user authentication. FTP cannot be used unless the correct user name and password are entered when making connection with FTP client.

For EtherNet/IP Units, the user name is "KV" (upper-case, half-width characters) (fixed), and the password can be set up in Unit Editor. The password should be only eight half-width alphanumerics including "_". Password entry is case-sensitive.

"3-1 Unit Editor Setting", page 3-2

Point

Please use the user name of "KVIE" (upper-case, half-width characters) when Microsoft Internet Explore is used to execute FTP. If "KV" is entered as the user name in the software, some functions cannot be used normally due to software restrictions.

"Procedures of executing FTP with Internet Explorer", page 11-21

■ Number of connections of FTP

The maximum number of connections of FTP is 4.

Four users can log in at the same time. However, when you logged in under Internet Explorer, two or more connections can be used at once.

■ Restrictions on memory card

Restrictions on transferable file size

When transferring files to memory card, the largest file size that can be transferred is the value obtained by subtracting 4KB from the free space of memory card.

The free space of memory card can be checked with the following methods. Check should be carried out with the memory card inserted into the CPU unit.

- **Check in access window**

  Check free space from the "6. Memory Card" menu in the access window of CPU unit.
- **Check with FTP server**

  After the memory card inserted into the CPU unit, set the CPU unit to PROG mode, access the root directory of the server, and check "MMC_Free_nnnnnKB" (nnnn is the free space (KB) of the memory card).

Reference There is no restrictions on number of folders and files that can be created.

FTP Functions and Operating Principle

The following describes the general functions and operating principle of FTP.

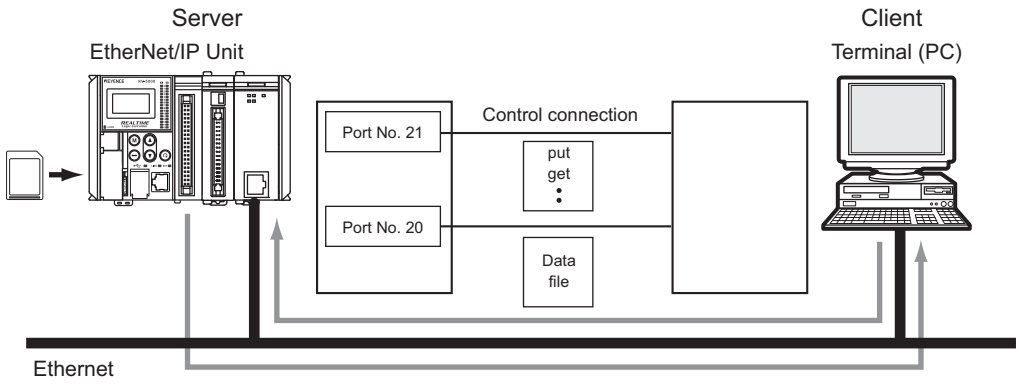
■ FTP execution procedure

FTP (File Transfer Protocol) is a protocol for transferring files over the network.
The procedure for executing FTP is as follows.

(1) The client (user) requests for connection to the server (EtherNet/IP Unit).
(2) Upon successful connection, the server authenticates that the connected user is a usable user. (The server requests the client to enter the user name and password).
(3) When the user is authenticated, files can be transferred. The user can acquire file data on the server, and also files can be transferred to the server from the user.
(4) The connection is cut-off.

■ Connection port

Normally, the FTP server uses port No. 20 and 21 of TCP to establish the connection.
Firstly, the control connection is established on port No. 21. This connection is used for exchanging various commands and responses for FTP control. After user authentication, the server opens port No. 20 to establish the data connection. Files are actually transferred on this port. The port used on FTP server is automatically specified by the FTP protocol.



■ Application for using FTP

Generally, FTP client software is required to use FTP. FTP client software allows files to be transferred easily as procedures (e.g. establishment of connection with server, file transfer) are executed automatically.

11-2 FTP Server Function of EtherNet/IP Units

This section describes the content of files that can be read/written using the FTP server function of EtherNet/IP Units, and other functions.

Check and Change of Operating Mode

The current operating mode of CPU unit can be checked by the type of file that is shown in the root directory. Also, the operating mode of CPU unit can be switched by reading specific files.

■ File for check/change of operating mode

When FTP connection is successful, the following files exist in the root directory of CPU unit.
These files are empty files without any content.
For the directory structure of each CPU unit, please refer to the following pages.

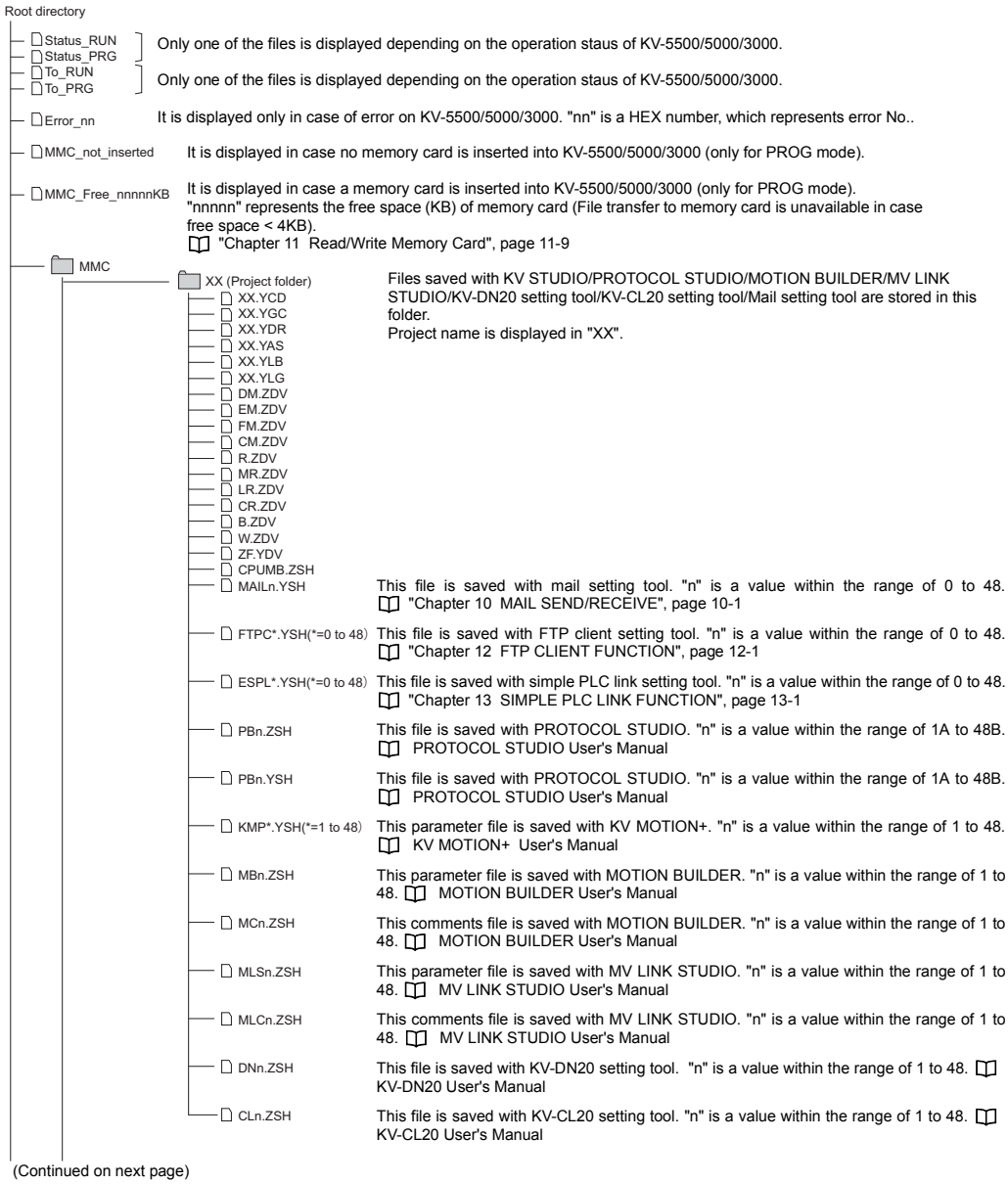
File name	Description
Status_RUN	It will be displayed when CPU unit is in RUN mode. It is not displayed in PROG mode.
Status_PRG	It will be displayed when CPU unit is in PROG mode. It is not displayed in RUN mode.
To_RUN*1	It will be displayed only when CPU unit is in PROG mode. CPU unit will be in RUN mode when reading this file.
To_PRG*1	It will be displayed only when CPU unit is in RUN mode. CPU unit will be in PROG mode when reading this file.
Error_nn	It will be displayed only in case an error occurs on CPU unit. "nn" represents error No..

*1 It will not be displayed when RUN/PROG switching of FTP server is set to "Disable" in Unit Editor.

Structure of Directory

The following illustrates the directory structure of the CPU unit to be used as the FTP server.

● For KV-5500 and KV-EP21V



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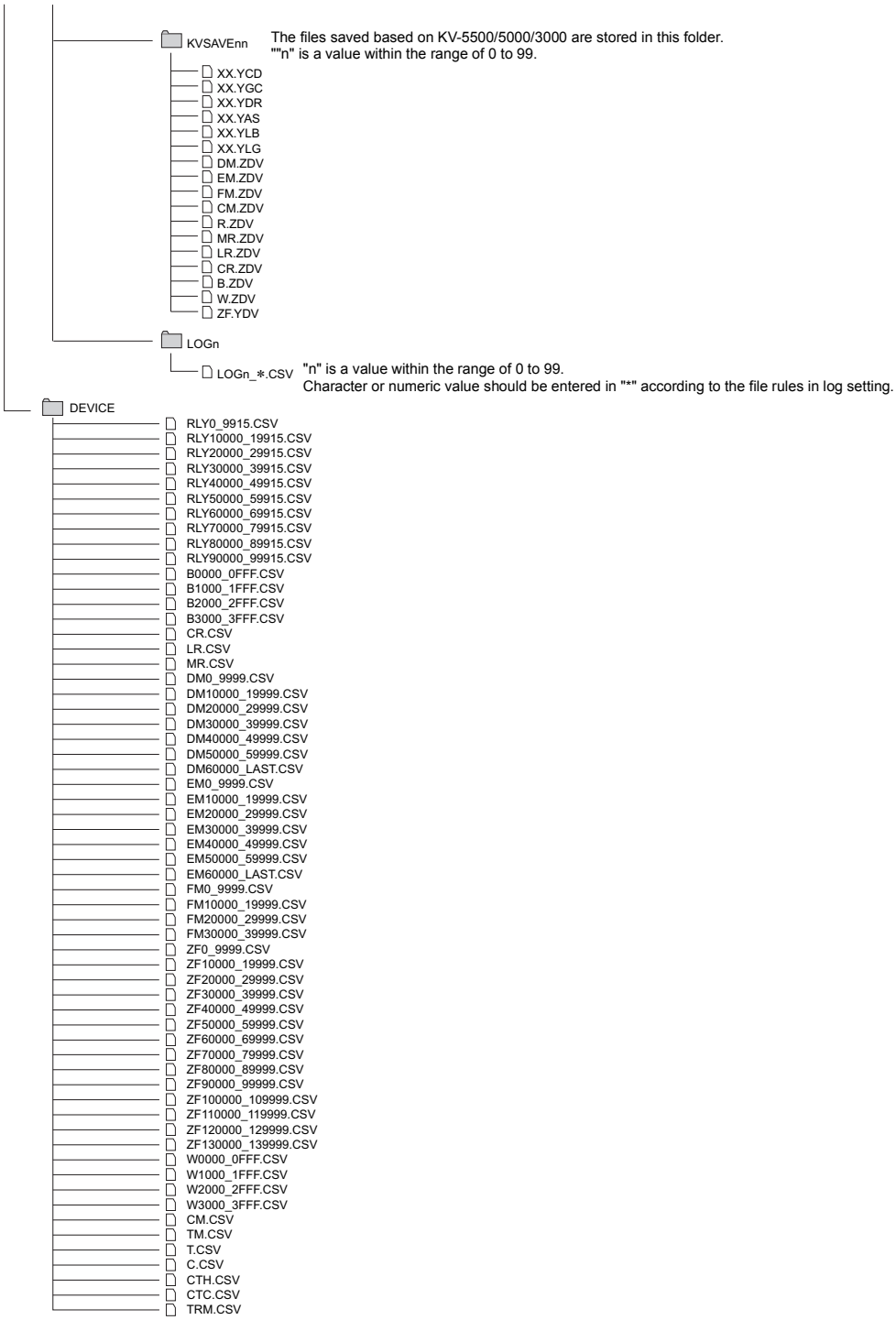
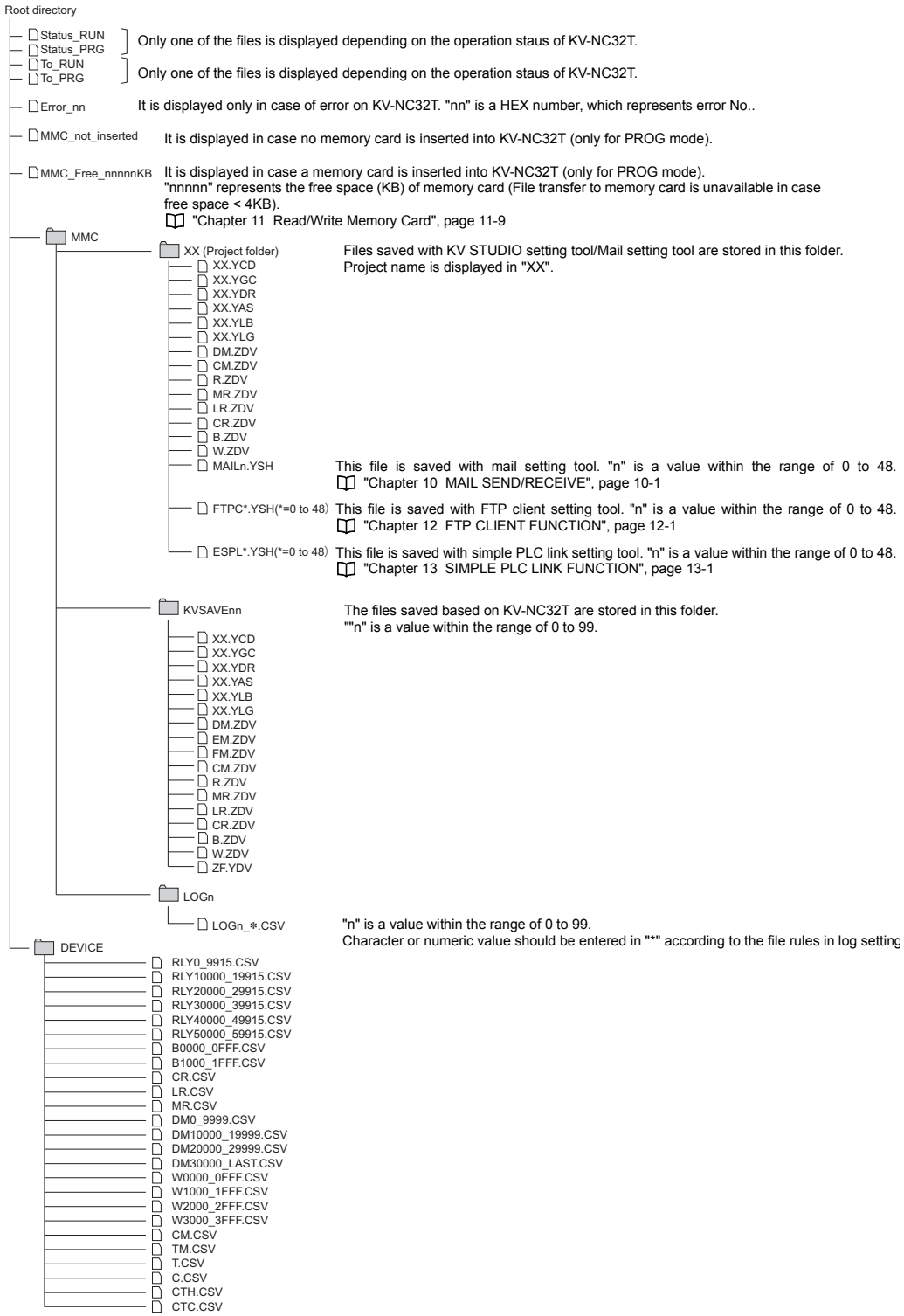


● For KV-NC1EP


Root directory
Status_RUN
Status_PRG
Only one of the files is displayed depending on the operation staus of KV-NC32T.
To_RUN
To_PRG
Only one of the files is displayed depending on the operation staus of KV-NC32T.
Error_nn
It is displayed only in case of error on KV-NC32T. "nn" is a HEX number, which represents error No..
MMC_not_inserted
It is displayed in case no memory card is inserted into KV-NC32T (only for PROG mode).
MMC_Free_nnnnnKB
It is displayed in case a memory card is inserted into KV-NC32T (only for PROG mode).
"nnnnn" represents the free space (KB) of memory card (File transfer to memory card is unavailable in case free space < 4KB).
"Chapter 11 Read/Write Memory Card", page 11-9
MMC
XX (Project folder)
Files saved with KV STUDIO setting tool/Mail setting tool are stored in this folder.
Project name is displayed in "XX".
XX.YCD
XX.YGC
XX.YDR
XX.YAS
XX.YLB
XX.YLG
DM.ZDV
CM.ZDV
R.ZDV
MR.ZDV
LR.ZDV
CR.ZDV
B.ZDV
W.ZDV
MAILn.YSH
This file is saved with mail setting tool. "n" is a value within the range of 0 to 48.
"Chapter 10 MAIL SEND/RECEIVE", page 10-1
FTPC*.YSH(*=0 to 48)
This file is saved with FTP client setting tool. "n" is a value within the range of 0 to 48.
"Chapter 12 FTP CLIENT FUNCTION", page 12-1
ESPL*.YSH(*=0 to 48)
This file is saved with simple PLC link setting tool. "n" is a value within the range of 0 to 48.
"Chapter 13 SIMPLE PLC LINK FUNCTION", page 13-1
KVSAVEnn
The files saved based on KV-NC32T are stored in this folder.
""n" is a value within the range of 0 to 99.
XX.YCD
XX.YGC
XX.YDR
XX.YAS
XX.YLB
XX.YLG
DM.ZDV
EM.ZDV
FM.ZDV
CM.ZDV
R.ZDV
MR.ZDV
LR.ZDV
CR.ZDV
B.ZDV
W.ZDV
ZF.YDV
LOGn
LOGn_*.CSV
"n" is a value within the range of 0 to 99.
Character or numeric value should be entered in "*" according to the file rules in log setting
DEVICE
RLY0_9915.CSV
RLY10000_19915.CSV
RLY20000_29915.CSV
RLY30000_39915.CSV
RLY40000_49915.CSV
RLY50000_59915.CSV
B0000_0FFF.CSV
B1000_1FFF.CSV
CR.CSV
LR.CSV
MR.CSV
DM0_9999.CSV
DM10000_19999.CSV
DM20000_29999.CSV
DM30000_LAST.CSV
W0000_0FFF.CSV
W1000_1FFF.CSV
W2000_2FFF.CSV
W3000_3FFF.CSV
CM.CSV
TM.CSV
T.CSV
C.CSV
CTH.CSV
CTC.CSV

Read/Write Memory Card

Files (log files, device files, ladder program files, etc.) in the memory card can be read and written (overwritten) when the memory card is inserted in the CPU unit.
Also, when writing the project folder "AUTOLOAD" and turning the CPU unit ON, or when writing the project folder "RUNLOAD" and switching from PROG->RUN, files in the same folder can be read to the CPU unit to change the ladder program or change the device values.

Reference When KV-NC1EP or KV-NC32T is being used, when storing in the "AtLoad**" or "RnLoad**" (**: 01 to 99) folder, a number can be specified and the power turned on again, or the mode can be changed from PROG to RUN.

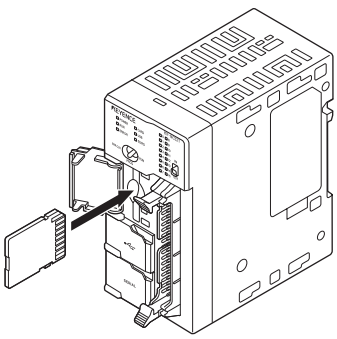
The file is created with KV STUDIO.

■ Memory card specification

The exclusive memory card (KV-M1G, KV-M256, KV-M128) specified by Keyence should be used.
Operation is not guaranteed if using memory cards not specified by Keyence.

■ Mounting/removal of memory card

Open the memory card slot cover, and insert the memory card as shown in the figure. Insert the memory card with the notch on the corner facing down.



Point

- **Never remove the memory card while the memory card access LED is blinking.**
- **In environment subject to severe noise, it may take time to access the memory card.**
  (In the worst case, this may damage the card or FAT (File Allocation Table)). In such cases, attach a ferrite core onto the power cable before use. Also, install the unit away from equipment that emits strong electromagnetic fields.

NOTICE	**Never remove the memory card or turn the CPU unit OFF while the memory card access LED is lit (reading/writing data to the memory card). Otherwise, the data in the memory card may be lost.**

11 FTP SERVER

■ Directory structure of MMC folder

There is a "MMC" folder in the root directory of CPU unit. If the Ladder program or log files are saved in the memory card, project folder or log folder exists under the MMC folder.
For the hierarchical structure of MMC folder, see "Structure of Directory", page 11-6.

Point

There are 5 folder layers under "MMC" folder.

The data managed using (project) folder in the memory card are as follows.

● For KV-5500 and KV-EP21V

Unit type	File type		File name	Save mode
KV-5500/5000/3000	CPU system setting Ladder program Global label Local label Local device comments		□.YCD[*1]	Access window KV STUDIO (File > Memory card)
	Global device comments		□.YGC[*1]	
	Device default value setting information		□.YDR[*1]	
	Communication setting information		□.YAS[*1]	
	Unit setting information		□.YLB[*1]	
	Logging/tracing setting information		□.YLG[*1]	
	Device file	DM	DM.ZDV	Access window KV STUDIO (Monitor/simulator > Batch change window)
		EM	EM.ZDV	
		FM	FM.ZDV[*2]	
		CM	CM.ZDV	
		R	R.ZDV	
		MR	MR.ZDV	
		LR	LR.ZDV	
		CR	CR.ZDV	
		B	B.ZDV	
		W	W.ZDV	
		ZF	ZF.YDV	
	CPU positioning function parameter file		CPUMB.ZSH[*3]	KV STUDIO (File > Memory card)
	Mail setting information		MAIL*.YSH (*=0 to 48)[*4]	Access window KV STUDIO (Mail setting tool)
	FTP client setting information		FTPC*.YSH(*=0 to 48)	Access window KV STUDIO (FTP client setting tool)
	Simple PLC link setting information		ESPL*.YSH(*=0 to 48)	Access window KV STUDIO (Simple PLC link setting tool)
KV-L20R	PROTOCOL STUDIO Ver 1 file		PB*.ZSH (*=1A to 48B)[*3]	PROTOCOL STUDIO Ver 1
KV-L20V	PROTOCOL STUDIO Ver 2 file (KV-L20R mode)		PB*.ZSH (*=1A to 48B)[*3]	PROTOCOL STUDIO Ver 2
	PROTOCOL STUDIO Ver 2 file (KV-L20V mode)		PB*.YSH(*=1A to 48B)	Access window PROTOCOL STUDIO Ver 2
Positioning/motion unit	Positioning/motion unit parameter file		KMP*.YSH(*=1 to 48)	KV MOTION+
Positioning unit	Positioning unit parameter file		MB*.ZSH(*=1 to 48)	MOTION BUILDER
	Positioning unit comments file		MC*.ZSH(*=1 to 48)	
MV-L40	MV-L40 parameter file		MLS*.ZSH(*=1 to 18)	MV LINK STUDIO
	MV-L40 comments file		MLC*.ZSH(*=1 to 18)	
KV-DN20	KV-DN20 parameter file		DN*.ZSH(*=1 to 48)	KV STUDIO (KV-DN20 setting tool)

Unit type	File type	File name	Save mode
KV-CL20	KV-CL20 Parameter file	CL*.ZSH(*=1 to 48)	KV STUDIO (KV-CL20 setting tool)

*1 "□" is the same as project folder name.

*2 FM of current bank is saved in FM.

*3 Could not save from access window to the memory card. The setting itself is saved in DM and CM, therefore, even if reading the above-mentioned project data without file, it could also work normally.

*4 When using KV-5500/5000 CPU built-in function to create mail setting, save as "MAIL0.YSH".

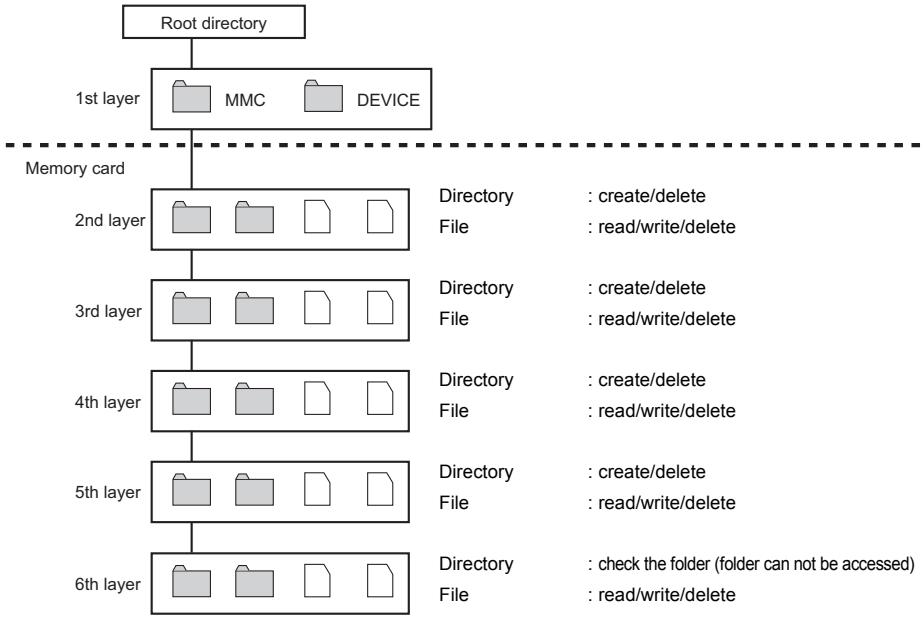
● For KV-NC1EP

Unit type	File type		File name	Save mode
KV-NC32T	CPU system setting Ladder program Global label Local label Local device comments		□.YCD*1	When CR3000 changes from OFF to ON KV STUDIO (File>Memory card)
	Global device comments		□.YGC*1	
	Device default value setting information		□.YDR*1	
	Communication setting information		□.YAS*1	
	Unit setting information		□.YLB*1	
	Logging/tracing setting information		□.YLG*1	
	Internal/extension device setting information		□.YSH	
	Device file	DM	DM.ZDV	When CR3000 changes from OFF to ON KV STUDIO (Monitor/simulator >device value batch change/readout window)
		CM	CM.ZDV	
		R	R.ZDV	
		MR	MR.ZDV	
		LR	LR.ZDV	
		CR	CR.ZDV	
		B	B.ZDV	
		W	W.ZDV	
	Version information when memory card data is created		Savelog.txt	When CR3000 changes from OFF to ON KV STUDIO

*1 "□" is the same as project folder name.

■ Access range of memory card

When memory card has the following directory structure, accessible (read/write) folders and files are as follows.



■ File/folder name restriction

Number of characters: half-width 249 characters (including end code NULL)
Character code: Shift JIS code

For half-width characters, the following characters cannot be used.
"$", "/", " (space)", "*", "?", ",", """, ":", ";", "<", ">", "=", "+"

For full-width characters, the following characters can not be used.

NEC special character

Shift JIS	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
8740	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯
8750	⑰	⑱	⑲	⑳	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅴ	Ⅵ	Ⅶ	Ⅷ	Ⅸ	Ⅹ		ミリ
8760	キロ	センチ	メートル	グラム	トン	アール	ヘクタール	リットル	ワット	カロリー	ドル	セント	パーセント	ミリバール	ページ	mm
8770	cm	km	mg	kg	cc	m²									平成	
8780	〃	〃	No.	K.K.	TEL	㊤	㊥	㊦	㊧	㊨	㈱	㈲	㈹	明治	大正	昭和
8790	≒	≡	∫	∮	Σ	√	⊥	∠	∟	⊿	∵	∩	∪			

NEC specified IBM extension character

Shift JIS	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
ED40	纊	褜	鍈	銈	蒾	俉	炻	昱	棈	鋹	曻	彅	丨	仡	仼	伀
ED50	伃	伹	佖	佰	侒	侔	侚	俍	偀	倢	俿	倞	偆	偰	偂	傔
ED60	僃	僘	兊	兤	冝	冾	凬	刕	劜	勀	勛	匀	匆	匤	卲	
ED70	厓	厲	叝	叡	叩	叶	另	咒	咔	咟	坱	垉	埈	埇	埼	
ED80	塚	增	墲	夋	奓	奛	奝	奣	妤	妹	孖	寀	甯	寘	寬	尞
ED90	岦	岺	峵	崧	嵓	崗	嵂	嵓	嶸	嶠	巐	弡	弴	彧	德	忞
EDA0	恝	悅	悊	悞	悳	惲	愑	愠	愰	愱	戓	抦	揵	摠	撝	
EDB0	擡	敎	昀	昕	昻	昉	昜	晒	晗	晥	晗	晙	晴	朁	暆	暠
EDC0	暲	暿	曺	朎	朗	杦	枻	桒	柀	栁	桄	棏	栖	楨	榘	槢
EDD0	樰	橫	橆	橳	橾	櫢	櫤	毖	氿	汜	沆	汦	泚	洄	涇	
EDE0	浯	涖	涬	淏	淸	淲	淼	渹	湜	渧	渼	溿	澈	澵	濵	瀅
EDF0	瀇	瀨	炅	炫	焃	焄	煇	煆	煇	熙	爀	燾	狚			

Shift JIS	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
EE40	狀	猘	猪	獷	玽	珉	珖	珣	珒	琇	琄	琦	琪	琩	琮	瑢
EE50	璉	璟	甁	畯	皂	皜	皞	皛	皦	益	睆	劯	砡	硎	硤	硺
EE60	礰	礼	神	祥	禔	福	禛	竑	竧	靖	竫	箸	精	絈	絜	
EE70	綷	綠	緖	繒	罇	羡	羽	茁	荢	菠	菇	葦	菜	葡	蒴	蕓
EE80	蕙	蕫	薰	蘊	蚌	蠣	褽	訒	詽	詹	誧	誾	諟	諸	諶	譓
EE90	譿	賰	賴	贒	赶	趁	軏	迟	逸	達	郎	都	鄉	鄧	釚	釗
EEA0	釕	釭	釮	鈁	鈔	鈆	鈐	鈇	鈺	鉀	鉐	鉏	鉑	鈹	鉷	
EEB0	銧	鉾	鋏	鋗	鋟	鋩	鋳	鋹	鋺	鍊	錆	錡	錤	錟	錠	鍞
EEC0	鍋	鍰	鍤	鍰	鍚	鍞	鐗	鏞	鏸	鐱	鑅	鑈	閒	隆	隝	隯
EED0	霣	霳	霻	霿	靁	靄	靑	靖	顗	顯	飯	飼	餧	館	馼	騹
EEE0	髙	鬟	鮀	鮏	鮱	鮫	鮻	鰒	鵬	鵨	鶴	鸙	黑			ⅰ
EEF0	ⅱ	ⅲ	ⅳ	ⅴ	ⅵ	ⅶ	ⅷ	ⅸ	ⅹ	￢	￤	'	"			

IBM specified IBM extension character

Shift JIS	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
FA40	ⅰ	ⅱ	ⅲ	ⅳ	ⅴ	ⅵ	ⅶ	ⅷ	ⅸ	ⅹ	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅴ	Ⅵ
FA50	Ⅶ	Ⅷ	Ⅸ	Ⅹ	￢	¦	'	"	㈱	№.	℡	∵	纊	褜	鍈	銈
FA60	蒻	喆	炻	昱	椙	鋹	曻	彅	丨	仡	仼	伀	伃	伹	佖	侒
FA70	侊	侚	佯	俍	俑	俓	俼	俽	俿	個	倹	倩	倬	俵	兗	
FA80	冤	冨	凃	凬	刱	劚	勀	勛	匀	匆	匤	卲	厓	厲	叡	
FA90	叟	哢	唎	唩	嘐	喆	塁	坦	堯	埈	堝	垉	塚	增	墲	夋
FAA0	奓	奮	奩	奭	妤	妹	孖	寀	甯	寘	寬	尞	岦	岺	峵	崧
FAB0	嵓	崎	嵫	嵮	嶢	嶬	巐	弡	弴	彧	德	忞	恝	悅	悊	惞
FAC0	惕	愠	惲	愑	愷	愰	憘	戓	抦	揵	摠	撝	擎	敎	昀	昕
FAD0	昇	昉	晥	晗	晙	晛	暔	暘	暠	暲	暿	曺	朎	札	杹	栁
FAE0	浪	桒	栔	桼	梀	栁	桄	棏	椻	楨	樘	橆	橳	橫	檧	欵
FAF0	歖	歠	毾	毿	氹	汎	汜	沆	汯	泚	洄	涇	浯			

Shift JIS	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
FB40	淲	淸	淊	清	滊	滖	滔	灴	烝	渻	焾	牐	漸	濵	澁	濶
FB50	瀨	炅	炫	焃	焄	煜	煆	煇	熙	燁	燾	犱	犮	猤	猪	獷
FB60	玽	珉	珖	珣	珒	琇	珵	琦	琪	琩	琮	瑢	璉	璟	甁	畯
FB70	皂	皜	皞	皛	皦	益	睆	劯	砡	硎	硤	碌	礰	礼	神	
FB80	祥	禔	福	禛	竑	竧	靖	竫	箞	精	絈	絜	綷	綠	緖	繢
FB90	罇	羡	羽	茁	荢	菠	菇	荺	菉	葖	藁	蒨	蕤	薰	蘒	虧
FBA0	蚉	蠇	裵	訒	訷	詹	誧	豎	踐	諸	諶	諫	讌	豖	賴	贒
FBB0	赶	赳	軏	迟	逸	遧	郎	都	鄉	鄧	釗	釗	釵	釭	鈇	鈐
FBC0	鈔	鈆	鈐	鈖	鈕	鉀	鉐	鉎	鉝	鉑	鈹	鉇	銧	鉉	銨	銀
FBD0	銷	鋗	鋐	鋒	鋿	鋹	錝	錥	錡	鍈	錘	錞	鋼	錝	錢	錟
FBE0	錦	錕	鑕	鏰	鏸	鑑	鑅	鑼	閒	隆	陽	隩	隣	靈	靈	靨
FBF0	靨	鸙	靑	靖	顗	顯	飯	飼	餧	館	馼	驎	髙			

Shift JIS	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
FC40	鬺	鯰	鮴	鮎	鯱	鯕	鰋	鷆	鷯	鷺	鸙	黑				

■ RUNLOAD folder and AUTOLOAD folder

File in the folder of project name "RUNLOAD" can be read automatically in case of PROG->RUN switching for CPU unit. File in the folder of project name "AUTOLOAD" can be read automatically in case of power on of CPU unit. FTP function can be used to replace Ladder program file and device file in these folders into other files, so as to change the Ladder program and device value for CPU unit.

Reference For KV-NC1EP or KV-NC32T, when storing in the "AtLoad**" or "RnLoad**" (**: 01 to 99) folder, a number can be specified and the power turned on again, or the mode can be changed from PROG to RUN.

■ Log file

Log refers to the monitoring record of status or change of the device in certain time point.

The information of device and trigger etc. to be monitored via ladder program will be registered into control memory and control relay, and saved in the memory card. The log data are in CSV format, so as to import to tabular calculation software (such as Excel) for analysis.

Log data are saved in "LOGGING" folder of the memory card. File name is changed to “LOGXX” (XX refers to the value within the range of 00 to 99), unused No.s are assigned from 00 in turn.

KV-5500/5000/3000 Series User's Manual "2-2 memory card"

KV Nano Series (connector type) User's Manual "5-11 Memory Card"

Read CPU Unit Device Value

Files recording device value and status of the CPU unit can be read. These files are read-only files, and can not be written.
The files are in the format of CSV.
The files can be read in either operation of stop status of CPU unit.

■ Content of the DEVICE folder

When FTP is connected successfully, "DEVICE" folder is displayed in the root directory.
DEVICE folder contains the following files.

● For KV-5500 and KV-EP21V

File name	Description
RLY0_9915.CSV	Record the value of R00000 to 09915.
RLY10000_19915.CSV	Record the value of R10000 to19915.
RLY20000_29915.CSV	Record the value of R20000 to 29915.
RLY30000_39915.CSV	Record the value of R30000 to 39915.
RLY40000_49915.CSV	Record the value of R40000 to 49915.
RLY50000_59915.CSV	Record the value of R50000 to 59915.
RLY60000_69915.CSV	Record the value of R60000 to 69915.
RLY70000_79915.CSV	Record the value of R70000 to 79915.
RLY80000_89915.CSV	Record the value of R80000 to 89915.
RLY90000_99915.CSV	Record the value of R90000 to 99915.
B0000_0FFF.CSV	Record the value of B0000 to 0FFF.
B1000_1FFF.CSV	Record the value of B1000 to 1FFF.
B2000_2FFF.CSV	Record the value of B2000 to 2FFF.
B3000_3FFF.CSV	Record the value of B3000 to 3FFF.
CR.CSV	Record the value of CR0000 to 3915.
LR.CSV	Record the value of LR00000 to 99915.
MR.CSV	Record the value of MR00000 to 99915.
DM0_9999.CSV	Record the value of DM00000 to 09999.
DM10000_19999.CSV	Record the value of DM10000 to 19999.
DM20000_29999.CSV	Record the value of DM20000 to 29999.
DM30000_39999.CSV	Record the value of DM30000 to 39999.
DM40000_49999.CSV	Record the value of DM40000 to 49999.
DM50000_59999.CSV	Record the value of DM50000 to 59999.
DM60000_LAST.CSV	Record the value of DM60000 to 65534.
EM0_9999.CSV	Record the value of EM00000 to 09999.
EM10000_19999.CSV	Record the value of EM10000 to 19999.
EM20000_29999.CSV	Record the value of EM20000 to 29999.
EM30000_39999.CSV	Record the value of EM30000 to 39999.
EM40000_49999.CSV	Record the value of EM40000 to 49999.
EM50000_59999.CSV	Record the value of EM50000 to 59999.
EM60000_LAST.CSV	Record the value of EM60000 to 65534.
FM0_9999.CSV	Record the value of FM00000 to 09999.
FM10000_19999.CSV	Record the value of FM10000 to 19999.
FM20000_29999.CSV	Record the value of FM20000 to 29999.
FM30000_39999.CSV	Record the value of FM30000 to 32767.
ZF0_9999.CSV	Record the value of ZF000000 to 009999.
ZF10000_19999.CSV	Record the value of ZF010000 to 019999.
ZF20000_29999.CSV	Record the value of ZF020000 to 029999.
ZF30000_39999.CSV	Record the value of ZF030000 to 039999.
ZF40000_49999.CSV	Record the value of ZF040000 to 049999.

File name	Description
ZF50000_59999.CSV	Record the value of ZF050000 to 059999.
ZF60000_69999.CSV	Record the value of ZF060000 to 069999.
ZF70000_79999.CSV	Record the value of ZF070000 to 079999.
ZF80000_89999.CSV	Record the value of ZF080000-089999.
ZF90000_99999.CSV	Record the value of ZF090000 to 099999.
ZF100000_109999.CSV	Record the value of ZF100000 to 109999.
ZF110000_119999.CSV	Record the value of ZF110000 to 119999.
ZF120000_129999.CSV	Record the value of ZF120000 to 129999.
ZF130000_139999.CSV	Record the value of ZF130000 to 131071.
W0000_0FFF.CSV	Record the value of W0000 to 0FFF.
W1000_1FFF.CSV	Record the value of W1000 to 1FFF.
W2000_2FFF.CSV	Record the value of W2000 to 2FFF.
W3000_3FFF.CSV	Record the value of W3000 to 3FFF.
CM.CSV	Record the value of CM0000 to 5999.
TM.CSV	Record the value of TM000 to 511.
T.CSV	Record the value of T0000 to 3999.
C.CSV	Record the value of C0000 to 3999.
CTH.CSV	Record the value of CTH0 to 1.
CTC.CSV	Record the value of CTC0 to 3.
TRM.CS	Record the value of TRM0 to 7.

- **For KV-NC1EP**

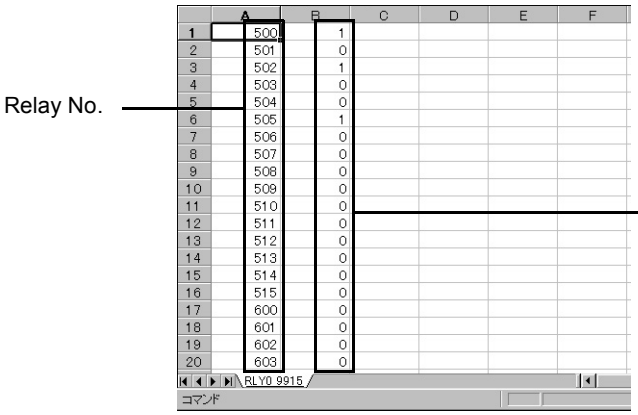
File name	Description
RLY0_9915.CSV	Record the value of R00000 to 09915.
RLY10000_19915.CSV	Record the value of R10000 to19915.
RLY20000_29915.CSV	Record the value of R20000 to 29915.
RLY30000_39915.CSV	Record the value of R30000 to 39915.
RLY40000_49915.CSV	Record the value of R40000 to 49915.
RLY50000_59915.CSV	Record the value of R50000 to 59915.
B0000_0FFF.CSV	Record the value of B0000 to 0FFF.
B1000_1FFF.CSV	Record the value of B1000 to 1FFF.
CR.CSV	Record the value of CR0000 to 8915.
LR.CSV	Record the value of LR00000 to 19915.
MR.CSV	Record the value of MR00000 to 59915.
DM0_9999.CSV	Record the value of DM00000 to 09999.
DM10000_19999.CSV	Record the value of DM10000 to 19999.
DM20000_29999.CSV	Record the value of DM20000 to 29999.
DM30000_LAST.CSV	Record the value of DM30000 to LAST.
W0000_0FFF.CSV	Record the value of W0000 to 0FFF.
W1000_1FFF.CSV	Record the value of W1000 to 1FFF.
W2000_2FFF.CSV	Record the value of W2000 to 2FFF.
W3000_3FFF.CSV	Record the value of W3000 to 3FFF.
CM.CSV	Record the value of CM0000 to 8999.
TM.CSV	Record the value of TM000 to 511.
T.CSV	Record the value of T000 to 511.
C.CSV	Record the value of C000 to 255.
CTH.CSV	Record the value of CTH0 to 2.
CTC.CSV	Record the value of CTC0 to 5.

Point

Device value of the files can be scanned for many times, and acquired from CPU unit (scanning synchronism can not be guaranteed)

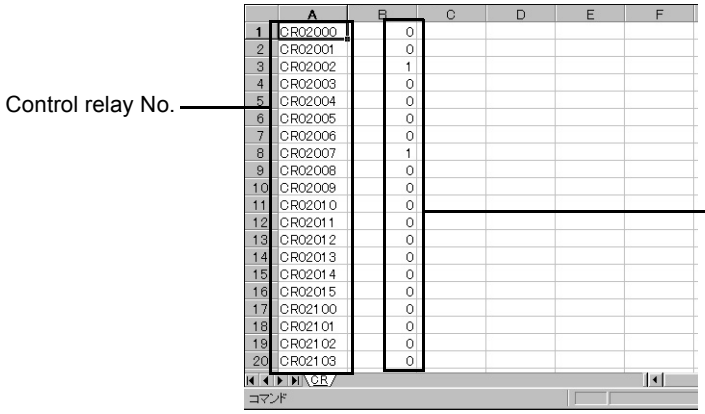
■ File example

RLY00000-09915.CSV (the same for RLY files starting from other No.)



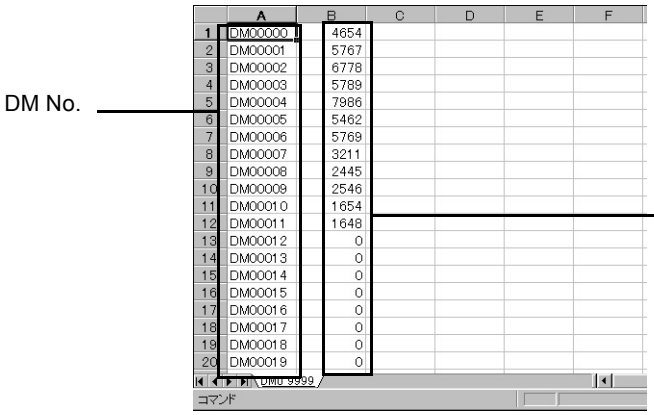
	A	B
1	500	1
2	501	0
3	502	1
4	503	0
5	504	0
6	505	1
7	506	0
8	507	0
9	508	0
10	509	0
11	510	0
12	511	0
13	512	0
14	513	0
15	514	0
16	515	0
17	600	0
18	601	0
19	602	0
20	603	0

CR.CSV (also the same for B, LR, and MR)



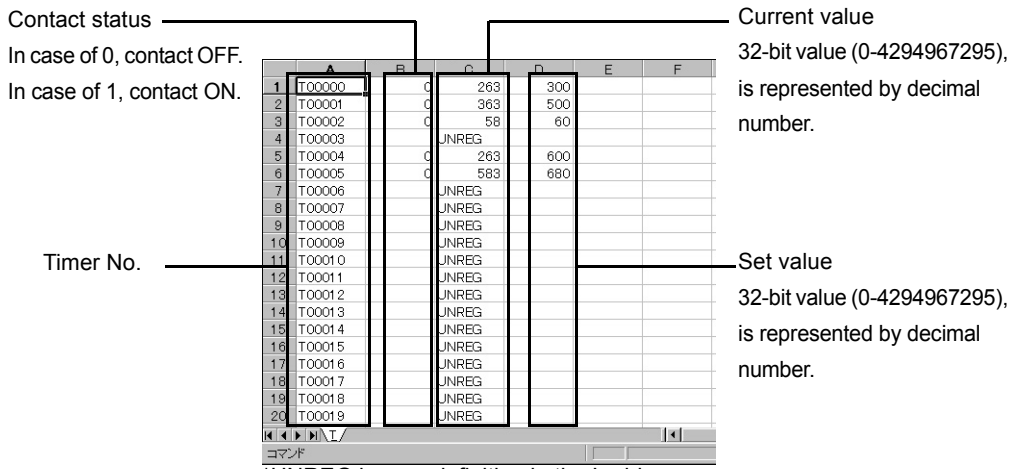
	A	B
1	CR02000	0
2	CR02001	0
3	CR02002	1
4	CR02003	0
5	CR02004	0
6	CR02005	0
7	CR02006	0
8	CR02007	1
9	CR02008	0
10	CR02009	0
11	CR02010	0
12	CR02011	0
13	CR02012	0
14	CR02013	0
15	CR02014	0
16	CR02015	0
17	CR02100	0
18	CR02101	0
19	CR02102	0
20	CR02103	0

DM0_9999.CSV (also the same for EM, FM, ZF, W, CM, TM, and TRM)



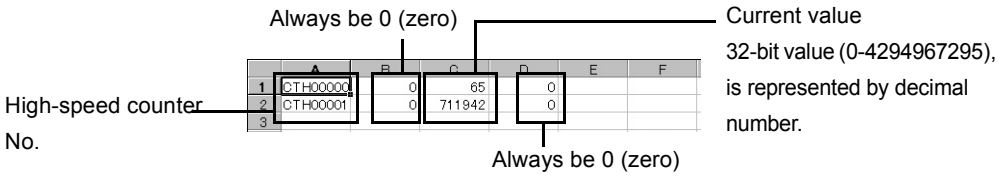
	A	B
1	DM00000	4654
2	DM00001	5767
3	DM00002	6778
4	DM00003	5789
5	DM00004	7986
6	DM00005	5462
7	DM00006	5769
8	DM00007	3211
9	DM00008	2445
10	DM00009	2546
11	DM00010	1654
12	DM00011	1648
13	DM00012	0
14	DM00013	0
15	DM00014	0
16	DM00015	0
17	DM00016	0
18	DM00017	0
19	DM00018	0
20	DM00019	0

T.CSV (also the same for C)



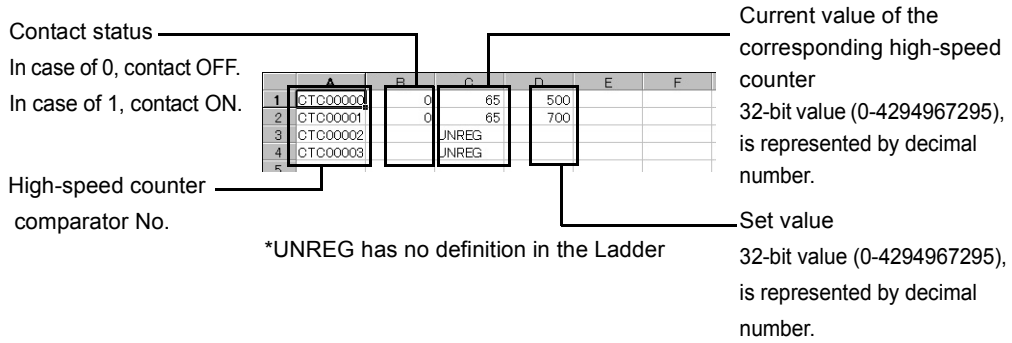
*UNREG has no definition in the Ladder

High-speed counter CTH.CSV



*UNREG has no definition in the Ladder

High-speed counter comparator CTC.CSV



*UNREG has no definition in the Ladder

11-3 FTP Operation with Internet Explorer

This section describes the procedures of using Internet Explorer to execute FTP.

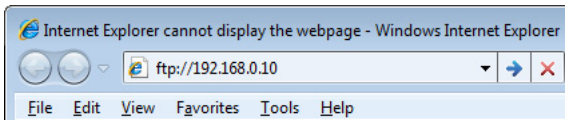
Procedures of executing FTP with Internet Explorer

The following describes the procedures of using Internet Explorer to execute FTP.
If Internet Explorer version is lower than Ver5.0, FTP cannot be used.
In the Internet Explorer, problems occur, latest information can not be acquired via cache or proxy server setting. Please use Internet Explorer on the basis of sufficient check.

"Restrictions on FTP Function Under Internet Explorer", page 11-23

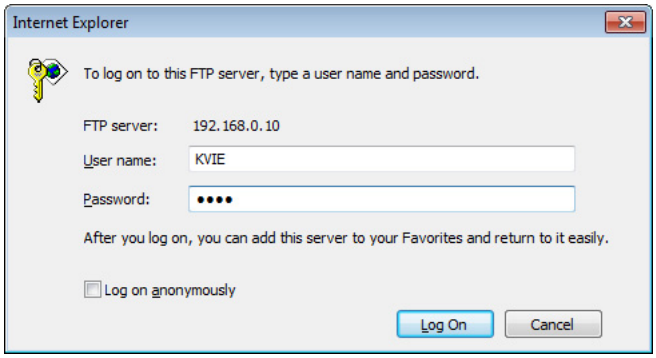
1 **Start Internet Explorer in client PC.**

2 **Enter "ftp://" in "Address" input box, then enter the IP address of KV-EP21V.**
(for example, IP address is "192.168.0.10")



3 **Press the Return key.**

Pop up the following dialog box.

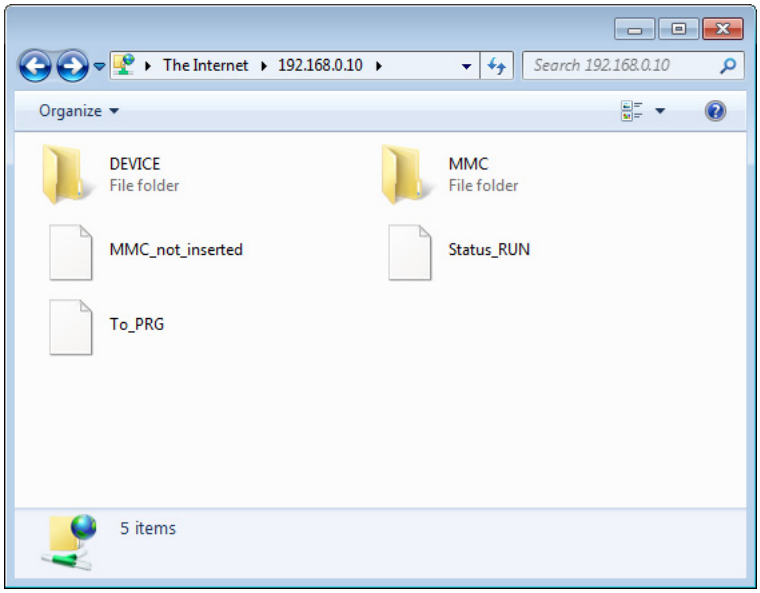


Reference

In "Address" input box of Step 2, if the user name and password to add to IP address are specified, the above-mentioned dialog box will not appear, and FTP connection can be performed.
(Example) IfIP address = "192.168.0.10", user name = "KVIE", password = "passwd", please enter "ftp://KVIE:passwd@192.168.0.10".

4 **Enter "KVIE" in the "User Name" input box, enter FTP password set in Unit Editor in the "Password" input box, and click "Log-in" button.**

If correct password is entered, accessible folders and files in CPU unit (and SD/MMC) are displayed.



Point

User name "KVIE" is used only when Internet Explorer is used. If MS-DOS prompt or FTP client software is used, please use the user name of "KV".

Restrictions on FTP Function Under Internet Explorer

■ Cache and proxy server

If cache and proxy server is set, in case of file transfer, sometimes real-time data of CPU unit or MMC can not be acquired, data of PC cache will be acquired instead.

Log in FTP when proxy server is set to "Disable" or "Proxy Settings".

Open "LAN Setting" in the setting procedure -> "Control Panel" ->"Internet Options"->"Connection Tab", and uncheck "Proxy server" check box.

Or log-in except "Proxy Settings".

Setup in case cache is not used (not required for IE6.0).

Open the setting procedure ->"Control Panel"->Internet options"->"Internet temporary file setting in the general tab", and check “check at every page display”.

■ Precautions on start of CSV file

Double click CSV file of the server, select "Open" from the displayed dialog mode, Excel starts, the specified file is opened.

When this method is used to open several CSV files, number of connections increases, even if FTP is ended, the connection is also in remaining status. Therefore, server-side file must be acquired on the client (PC), then opened after FTP is ended.

11-4 FTP Operation Based on Command Prompt

This section describes the procedures of reading/writing files from client (PC) via FTP connection to the EtherNet/IP Unit. Here, executing FTP from command prompt is used as an example.

FTP start and log-in

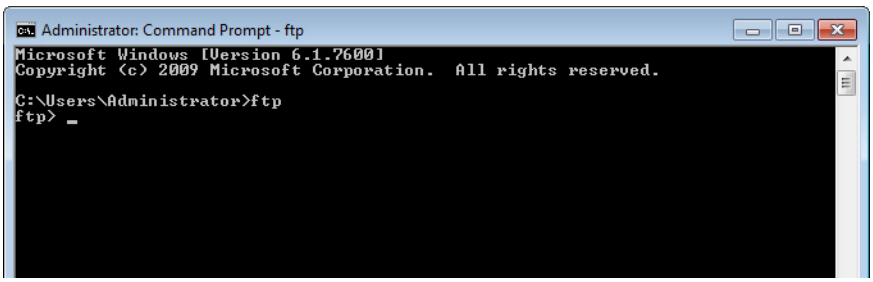
The procedures of starting and logging in FTP are described below.

1 **In client PC, select "Program" ▶ "Accessory" ▶ "Command Prompt" (or "MS-DOS Prompt") from the start menu.**

Command prompt starts. To transfer (write) file into EtherNet/IP Units, please move to the folder where the file to be transferred is located after the command prompt starts.

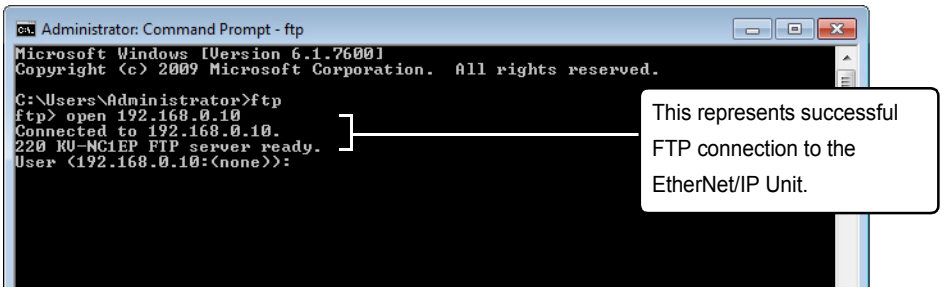
2 **Enter "FTP", and press "Enter" key.**

FTP Starts.



3 **Enter "open", leave a space, enter the IP address assigned to the EtherNet/IP Unit, and press the "Enter" key.**

Example: The EtherNet/IP Unit IP address is "192.168.0.10"



4 **Enter user ID for verification, and press "Enter" key.**

User ID is "KV" (upper-case, half-width characters) (fixed).

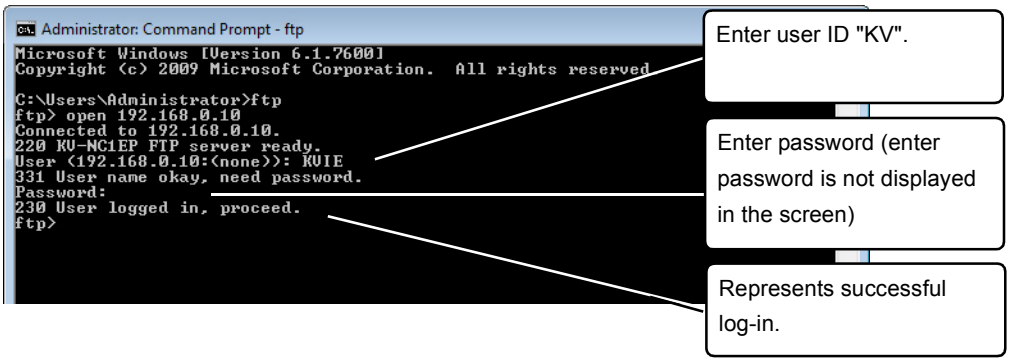
Point

When Internet Explorer is used to execute FTP, please use the user name "KVIE" (upper-case, half-width characters).

"11-3 FTP Operation with Internet Explorer", page 11-21

5 **Enter password, and press "Enter" key.**

The password set in the Unit Editor should be entered. If "Unset" is set in the Unit Editor, please do not enter anything, and press "Enter" key.



Upon verification, it displays "User logged in, proceed.".

File Reading and Writing

Here, with reading "DM0_9999.CSV" file under "DEVICE" directory of CPU unit as an example, the status after log-in is described .

1 Use 1s command (file list command) to check the file or directory in current folder. Enter "ls", and press "Enter" key.



Point

Behind ls command, if a space, and "-l" option are added, detail information of the file or directory (file attribute, creation time, file name) will be displayed.

2 Use cd command (directory movement command) to move current directory into "DEVICE", Enter "cd DEVICE", and press "Enter" key.



3 **Use 1s command to display file list in current directory (DEVICE directory). Enter "ls", and press "Enter" key.**

```
250 CWD Device
ftp> ls
200 PORT command successful.
150 Opening data connection for (NLST) (192.168.0.250,49218).
/DEVICE/RLY0_9915.CSV
/DEVICE/RLY10000_19915.CSV
/DEVICE/RLY20000_29915.CSV
/DEVICE/RLY30000_39915.CSV
/DEVICE/RLY40000_49915.CSV
/DEVICE/RLY50000_59915.CSV
/DEVICE/RLY60000_69915.CSV
/DEVICE/RLY70000_79915.CSV
/DEVICE/RLY80000_89915.CSV
/DEVICE/RLY90000_99915.CSV
/DEVICE/CR.CSV
/DEVICE/MR.CSV
/DEVICE/LR.CSV
/DEVICE/EM0_9999.CSV
/DEVICE/EM10000_19999.CSV
/DEVICE/EM20000_29999.CSV
/DEVICE/EM30000_39999.CSV
/DEVICE/EM40000_49999.CSV
/DEVICE/EM50000_59999.CSV
/DEVICE/EM60000_LAST.CSV
/DEVICE/B0000_0FFF.CSV
/DEVICE/B1000_1FFF.CSV
/DEVICE/B2000_2FFF.CSV
```

File list in "DEVICE" directory.

4 **Use get command (file acquisition command) to copy the destination file (DM0_9999.CSV) to current directory of PC. Enter "getdm0_9999.CSV", and press "Enter" key.**

```
ftp> get DM0_9999.CSV
200 PORT command successful.
150 Opening data connection for (DM0_9999.CSV) (192.168.0.250,49356).
226 Transfer complete.
ftp:Received 150000 bytes 0.84 second 177.73KB/second
ftp>
```

Represents the end of file acquisition.

Through the above operations, destination file is copied to the client. When file of client is transferred (written) to KV, please do not use get command, but use put command instead.

The file acquired by get command is copied to the folder selected when executing FTP (in this example, Windows folder of C drive).

"11-5 FTP Command List", page 11-28

5 **To exit file reading/writing, use close command (exit connection) to cut off the connection with the server (EtherNet/IP Unit). Enter "close", and press "Enter" key.**

6 **Use quit command (exit FTP) to exit FTP. Enter "quit", and press "Enter" key.**

Exit FTP, and return to the prompt of current directory.

```
ftp> close
221 Service closing control connection.
ftp> quit

C:¥Windows>
```

Means that the connection with the server (EtherNet/IP Unit) is cut off.

Exit FTP, and return to the command prompt.

11-5 FTP Command List

FTP commands supported by EtherNet/IP Units are described below. These commands can be used to execute FTP from DOS prompt.

■ Supported FTP commands

Command name	Format	Function
appe	appe <File name >	Copy the specified file from client to current directory on the server side. If there is duplicate file, combine with it.
bye	bye	Cut off the line with server, and exit FTP.
cd	cd <Directory name>	Move current directory to the directory specified on server. Enter "cd.." to move to previous directory.
close	close	Cut off the connection with server.
delete	delete <File name >	Delete the file specified on sever.
dir	dir	Display file list in current directory of the server.
get	get <File name >	Copy the specified file to current directory of client PC from the server.
ls	ls	Display file list in current directory of the server.
mdelete	mdelete <File name >	Delete the specified files. Use wildcard "*" or "?" in the file name, multiple files can be specified.
mget	mget <File name >	Copy the specified files to current directory of client PC from the server. Use wildcard "*" or "?" in the file name, multiple files can be specified.
mkdir	mkdir <Directory name>	Create the specified directory under current directory of the server.
mput	mput <File name >	Copy the specified files to current directory on the server side from client. Use wildcard "*" or "?" in the file name, multiple files can be specified.
open	open <IP address >	Connect the specified FTP server.
put	put <File name >	Copy the specified file from client to current directory on the server side.
pwd	pwd	Display current directory on the server side.
quit	quit	Cut off the line with server, and exit FTP.
rmdir	rmdir <Directory name>	Delete the directory specified on server side. However, if any file or folder exists in the specified directory, it cannot be deleted.
user	user <User name>	If wrong user name is used in user authentication, please use the specified user name for log-in again.

12

FTP CLIENT FUNCTION

This chapter describes how to upload/download files using FTP client function after the connection with FTP server.

12-1 FTP Client Function Overview 12-2
12-2 FTP Client Function Setting 12-5
12-3 FTP File Transfer 12-10
12-4 Logging/Tracing Transfer 12-33
12-5 Other Functions 12-37

12-1 FTP Client Function Overview

This section gives a general description to FTP client function.

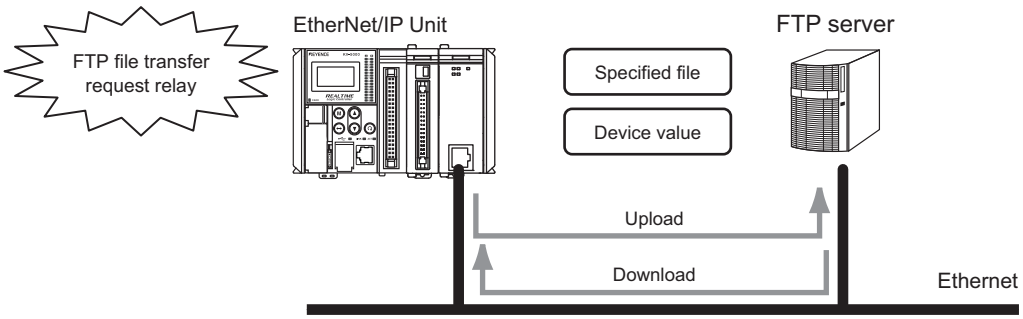
FTP Client Function Overview

With FTP client function, files in the memory card of CPU unit and device value in the CPU unit can be uploaded/downloaded via network.

■ FTP file transfer

The specified file or device value can be uploaded/downloaded to FTP server by setting FTP file transfer request relay to "ON".

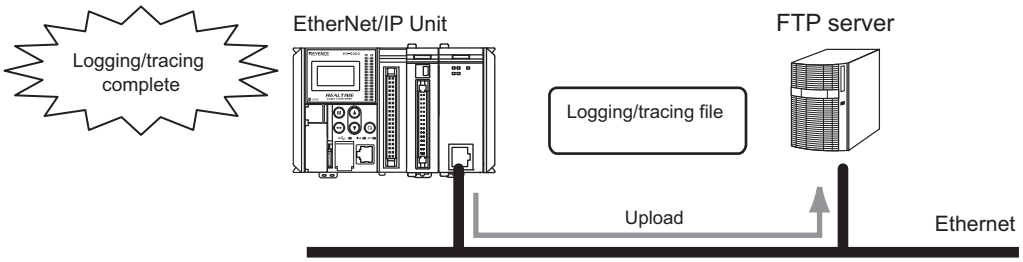
"FTP File Transfer", page 12-10



■ Logging/tracing transfer

After the logging/tracing files are created in CPU unit, these files will be uploaded to FTP server.

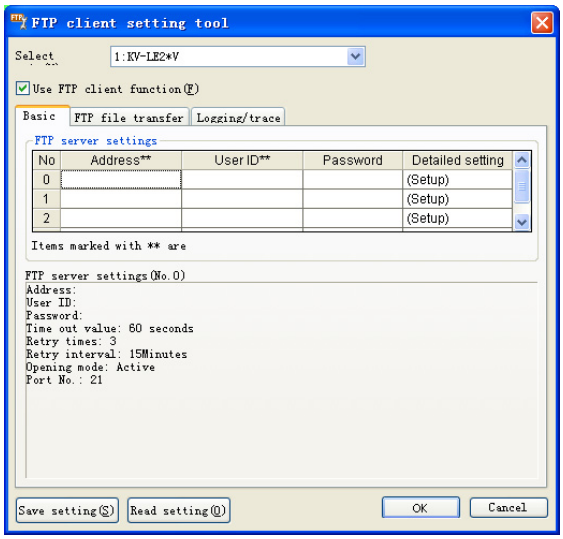
"Logging/Tracing Transfer", page 12-33



FTP Client Setting Tool

The setting tool is used to set up built-in FTP client in Ladder Supported Software KV STUDIO.

" Starting FTP Client Setting Tool", page 12-6



Specification of FTP Client Function

■ Specification of FTP client function

Item	Description
Number of simultaneous connections	1
Number of registered connection destinations	4
Connection mode	Select from Active mode and Passive mode.
File size	Upload: Max. 2GB (each file) Download: Max. 2GB (each file)
Other	• Auto retry • Auto delete file at successful upload/download • Specify wildcard of file name (*, ?)

Precautions on Using FTP Client Function

The following describes the precautions when using FTP client function to upload/download file to/from the FTP server.

■ Precautions on FTP client operation

● In case file with the same name is specified

- If a file with the same name exists in the specified folder when downloading, the file will be overwritten.
- If a file with the same name exists in the specified folder of FTP server when uploading, it will be processed as per the specification of FTP server.

● In case the specified folder does not exist

- If the specified folder does not exist when uploading, a folder with 8 levels at most will be automatically created.
  Error will occur and processing will be quitted if the folder can not be created.

● In case wildcard (*, ?) is used in the file name

- If error occurs to any file during uploading/downloading, uploading/downloading will be continued until the last file, and error is given after finishing, indicating that certain files can not be transferred.
- If error occurs to any file during uploading/downloading, uploading/downloading will be retried and the file is transferred with the same wildcard again. Thus after transfer failure, the formerly created file will be transferred again.
- If the function of delete file on successful upload/download is enabled, each file will be deleted when upload/download succeeds.
- Error will occur if the file matched with the wildcard exceeds 1001.

■ Precautions on FTP client setting

● Separator of folder

- "/(slash)" is used as the separator of folder.

● Characters unallowable in file name and folder name

- Half-width characters, such as "¥", "(space)", ",", """, ":", ";", "<", ">", "=", "+", "|", can not be used.
  For full-width characters unallowable, see "File/folder name restriction", page 11-13.
- Separator "/" of the folder can not be used continuously.
- Wildcard (*) can not be used continuously.
- Files with the name starting with "~" can not be downloaded.

● Restrictions on connection destination FTP server

- Some characters can not be used in folder name and file name depending on the connection destination FTP server. Set up folder name and file name in accordance with the specification of FTP server.

12-2 FTP Client Function Setting

This section describes the necessary settings when FTP client function is used.

Check Settings in Unit Editor

When the FTP client function of the EtherNet/IP Unit is used, the settings in the Unit Editor must be checked to make sure that the settings comply with the conditions as follows. If they do not, use Unit Editor to change the settings. For the setting method, see "3-1 Unit Editor Setting", page 3-2.

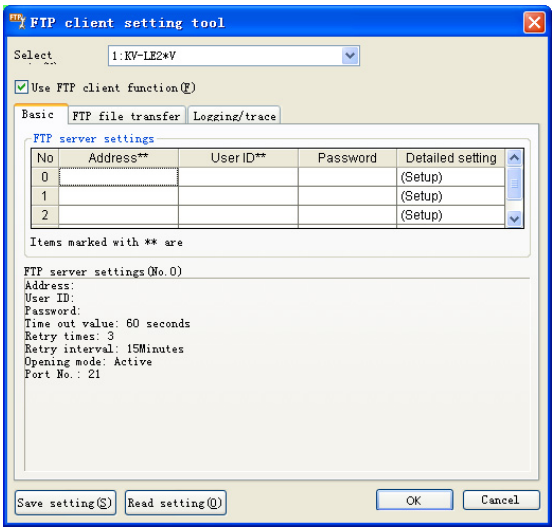
Item	Settings	Setting range	Default value	See page
Extended function	To set to “Enable“.	Enable/Disable	Disable	3-6
Leading DM No.	To set up a No. not used in other purposes.	0 to 65518	To be set up	3-6
Number of used DMs	Number of DMs used by the unit	16	16	-
Leading relay No. (set up by channel)	To set up a No. not used in other purposes.	10 to 960	To be set up	3-6
Number of used relays	Number of relays used by the unit	640	640	-
Communication rate	Please set up according to the network used.	100M/10Mbps Auto/ 10Mbps	100M/10Mbps Auto	3-6
IP address setting method	To set up the setting method of IP address.	Fixed IP address/ BOOTP->fixed IP Auto switching/BOOTP	Fixed IP address	3-6
IP address	Set up a IP address not duplicated with other nodes.	0.0.0.0 to 255.255.255.255	192.168.0.10	3-7
Subnet mask	Set up appropriate subnet mask.	0.0.0.0 to 255.255.255.255	255.255.255.0	3-7
Default gateway	Set up appropriate default gateway.	0.0.0.0 to 255.255.255.255	0.0.0.0	3-7
Receive time out[s]	Set to an appropriate value.	0 to 59	10	3-8
Keep Alive[s]	Please set to an appropriate value.	0 to 65535	600	3-8
Routing setting	Please set up as required.	Yes/No	No	3-10
Target IP address 1 to 6	Please set up as required.	0.0.0.0 to 255.255.255.255	0.0.0.0 (Disable)	3-10
Target subnet mask 1 to 6	Please set up as required.	0.0.0.0 to 255.255.255.255	0.0.0.0 (Disable)	3-10
Router IP address 1 to 6	Please set up as required.	0.0.0.0 to 255.255.255.255	0.0.0.0 (Disable)	3-10
DNS server	It is must be set up if the address of FTP server is set up with host name.	0.0.0.0 to 255.255.255.255	0.0.0.0 (Disable)	3-8

Starting FTP Client Setting Tool

In order to use FTP client function, KV STUDIO should be used to set up.

The following ways are available to open the setup window.

- Select "Tool(T)" -> "FTP client setting(J)" from the menu in turn.
- Click " " button
- Click the FTP client setting in the Unit Editor
- Click " " button in Unit Editor



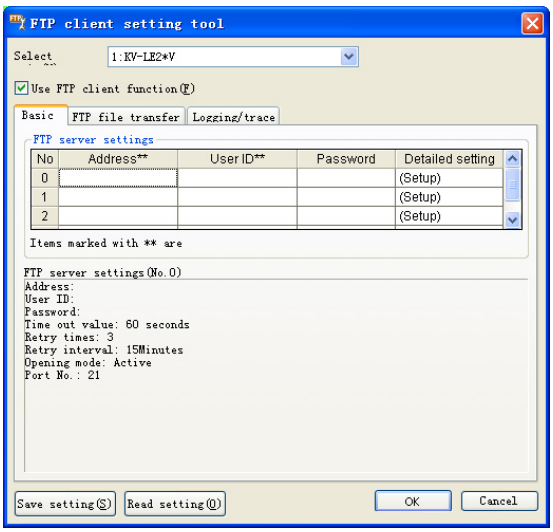
Item	Description
Select unit	To select the unit to which FTP client function needs to be set up.
Use FTP client function	To select to enable FTP client function.
Save setting	To save settings.
Read setting	To read the saved settings.

Basic (Tab)

FTP server and common items for using FTP client function can be set up in Basic tab.

For the settings of FTP file transfer, see "Necessary Setting for FTP File Transfer", page 12-12.

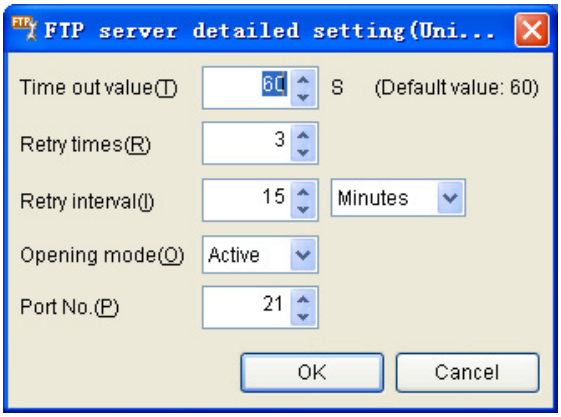
For the settings of logging/tracing transfer, see "Necessary Setting of Logging/Tracing Transfer", page 12-34.



● FTP server setting

Item	Description
Address	To set up the address or host name of FTP server. Maximum 256 half-width characters can be set.
User ID	To set up the user ID when connecting to FTP server. Maximum 32 half-width characters can be set.
Password	To set up the password when connecting to FTP server. Maximum 32 half-width characters can be set.
Detailed setting	Click it to open the dialog box of FTP server setting details.

● FTP server setting details

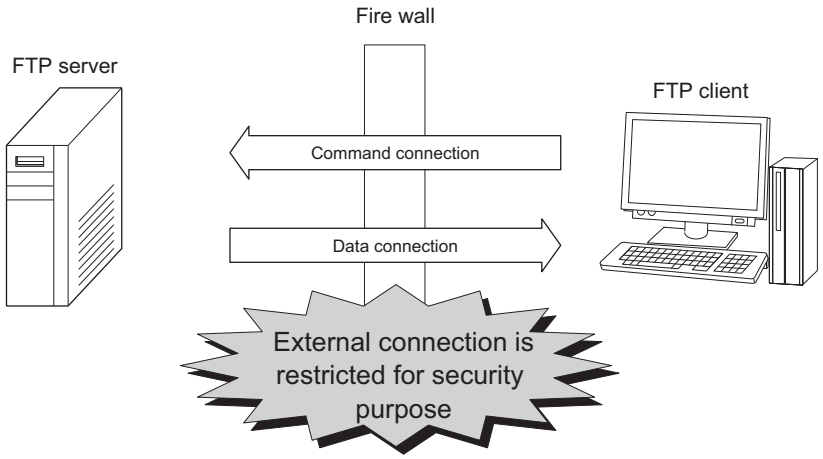


Item	Description
Timeout value	To set up the time out value when connecting to FTP server within the range of 30 to 300 (second). (Default Value: 60)
Retry times	To set up retry times within the range of 0 to 3 (times). (Default value: 3)
Retry interval	To set up retry interval. • In case the retry interval unit is "second": 1 to 3600 • In case the retry interval unit is "minute": 1 to 1440 (Default value: 15) • In case the retry interval unit is "hour": 1 to 24
Retry interval unit	To set up the unit of retry interval as second, minute or hour. (Default value: min)
Opening mode	To set up the open mode of FTP server as Active mode or Passive mode. (Default value: Active mode)
Port No.	To set up the port No. of FTP server within the range of 1 to 65535. (Default value: 21)

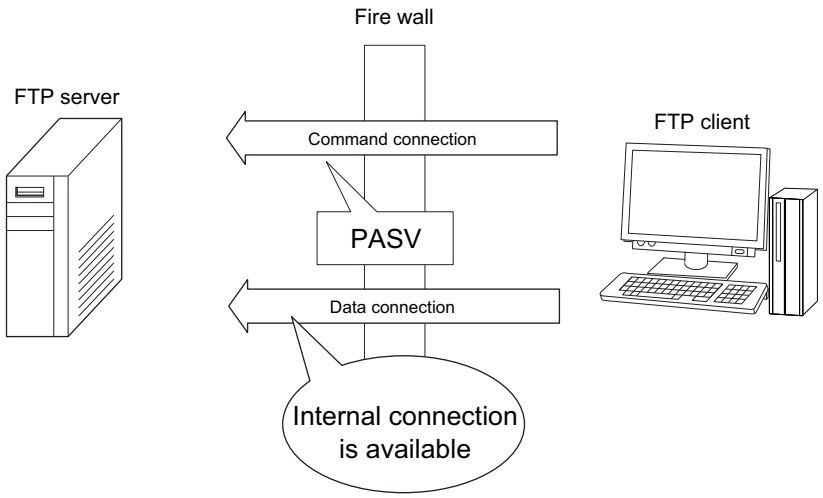
● Passive mode

When executing FTP, server should be connected with client, so as to establish data connection (communication for data transfer).

When connecting to other network via router or fire wall, the connection from server to client may be rejected, so as to prevent illegal connection outside of the fire wall invading into the inside.



When establishing data connection, if PASSIVE mode is used, data connection becomes to internal -> external communication, connection is available.



12-3 FTP File Transfer

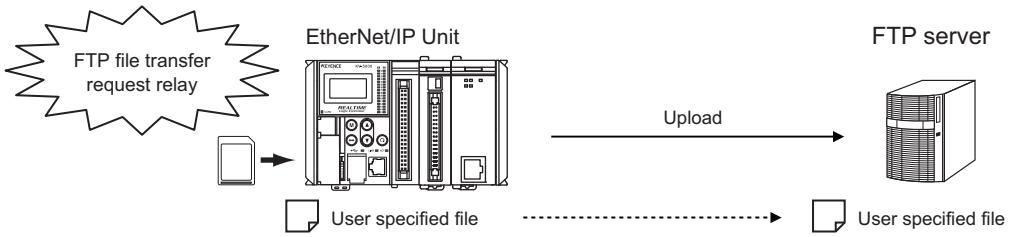
This section describes how to use the FTP file transfer function to upload/download the files in the memory card and device value in CPU unit into the FTP server.

FTP File Transfer Overview

With this function, by setting the FTP file transfer request relay to "ON", the files in the memory card and device value in the CPU unit can be uploaded/downloaded into the FTP server according to the FTP file transfer ID.

■ File upload

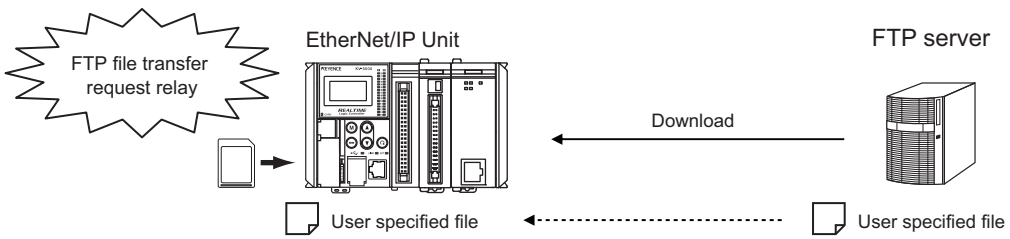
To transfer the specified file from the memory card of CPU unit to FTP server.



Reference Multiple files can be uploaded at a time by specifying wildcard (*, ?) in the file name.

■ File download

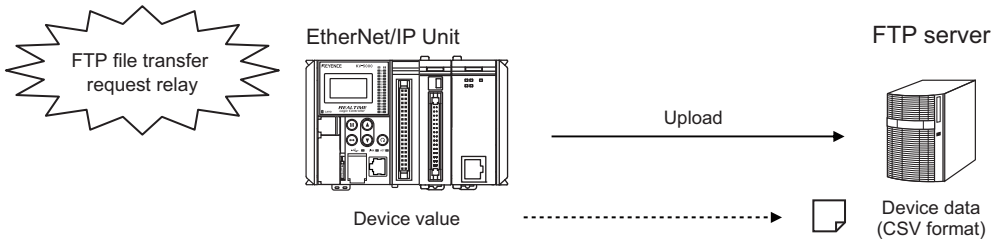
To download the specified file in the FTP server into the memory card of CPU unit.



Reference Multiple files can be downloaded at a time by specifying wildcard (*, ?) in the file name.

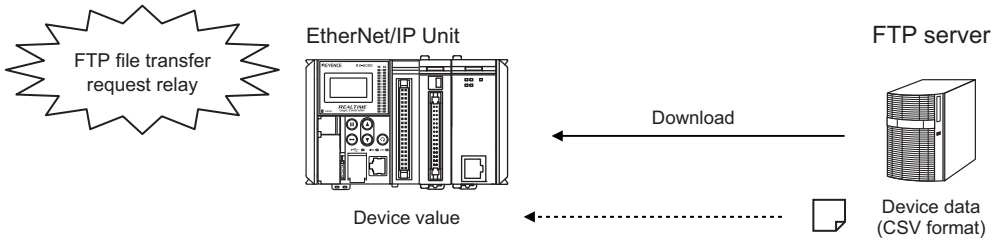
■ Device value upload

When uploading the specified device value in CPU unit, it is converted into CSV file, and then uploaded to FTP server.



■ Device value download

To download the device data file in FTP server, and write it into the device value in CPU unit.



Reference Multiple files can be downloaded, or multiple devices can be written in at a time by specifying wildcard (*, ?) in file name.

Point

Simultaneity of device value

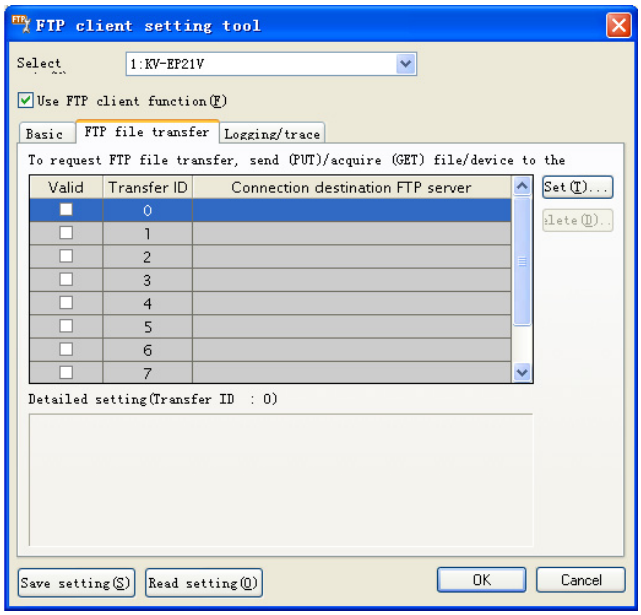
- **The device value in every two words starting from an even number is updated simultaneously.**
- **When downloading device value, FTP file transfer complete relay becomes ON after all device value is written in.**

Necessary Setting for FTP File Transfer

The following describes the necessary setting when executing FTP file transfer.
For common setting of FTP client function (such as FTP server setting), see " Starting FTP Client Setting Tool", page 12-6.

■ FTP file transfer (tab)

FTP file transfer settings of each ID are displayed.
10 IDs of FTP file transfer can be set up at most.

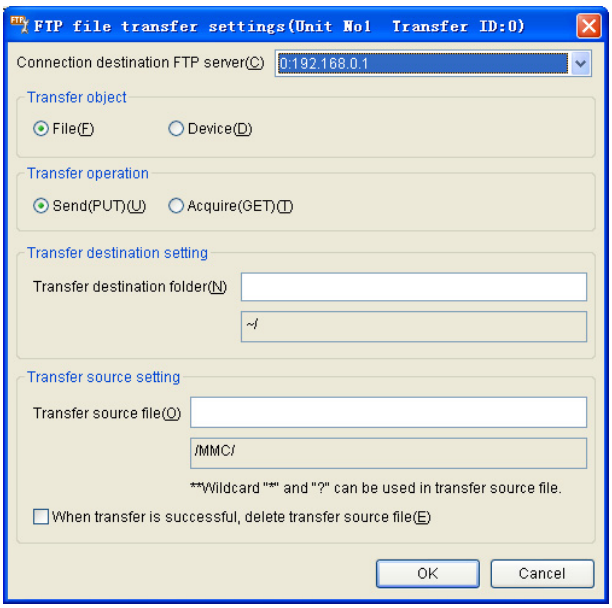


Item	Description
Valid	To select to enable selected FTP file transfer ID. If the FTP file transfer ID is not set, the dialog box of FTP file transfer setting will be opened by double click it.
Transfer ID	The ID No. of FTP file transfer
Connection destination FTP server	To display the FTP server set as connection destination.
Set	To open the dialog box of FTP file transfer setting of the selected FTP file transfer ID.
Delete	To delete the settings of the selected FTP file transfer ID.

■ FTP file transfer setting dialog box

This dialog box is used to set up FTP file transfer by their respective IDs.
Settings vary with transfer operation and transfer object.

● In case transfer object is "file"

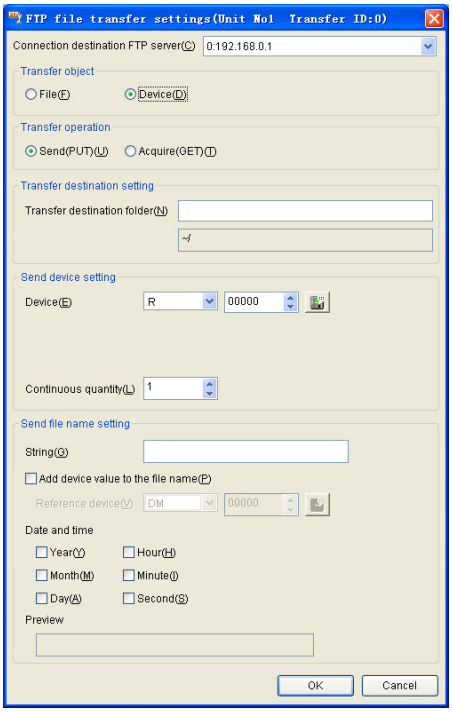


Item	Description
Connection destination FTP server	To select from the set FTP server.
Transfer object	To select the transfer object from file and device. (default setting: file)
Transfer operation	To select as PUT <upload> or GET <download> files. (Default value: PUT)
Transfer destination setting	When transfer operation is PUT, users may log in FTP server and the relative path of the root directory is used to specify the transfer destination folder. When transfer operation is GET, the absolute path of memory card is used to specify the transfer destination folder. Maximum 248 half-width characters can be set. *1
Transfer source setting	When transfer operation is PUT, the absolute path of memory card is used to specify the transfer source file. When transfer operation is GET, users may log in FTP server and the relative path of the root directory is used to specify the transfer source file. Maximum 248 half-width characters can be set. *1 Wildcard (*, ?) can be used in file name.
When transfer is successful, delete transfer source file	If checked, transfer source file will be deleted upon successfully executing PUT/GET file.

*1 For characters unallowable in folder name, see "Precautions on FTP client setting", page 12-4.

● In case transfer object is "device" and transfer operation is "Send(PUT) <upload>"

When uploading the device in CPU to FTP server, the target device and device range of data documenting should be set up.

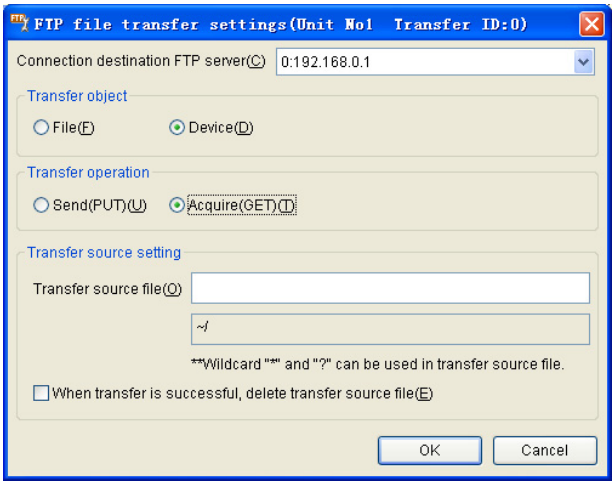


Item		Description	
Connection destination FTP server		To select from the set FTP server.	
Transfer object		To select the transfer object from file and device. (Default setting: file)	
Transfer operation		To select as PUT <upload> or GET <download>files. (Default value: PUT)	
Transfer destination setting		After logging in the FTP server, the relative path of the root directory is used to specify the transfer destination folder. Maximum 248 half-width characters can be set.	
Send device setting		To set up leading device No. and consecutive numbers of CPU unit which require data documenting. Maximum number of devices allowing datamation is 10,000.	
	Device	To set up as R, B, MR or LR.	To set up as DM, EM*, FM*, ZF* or W. * EM, FM and ZF cannot be used with KV-NC1EP.
	Data format	-	To set up data format according to the selected device.
	Number of words	-	If data format is ASCII, the number of words should be set up within the range of 1 to 64.
	Consecutive number	To set up datamation device range by bit. Maximum: 10,000 (bits)	To set up datamation device range by device. Maximum: 10,000 (devices)

Item		Description
Send file name setting		To set up file name in case of PUT.
	String	To set up additional character string at the beginning of file name. Maximum 16 half-width characters can be set.
	Add device value in file name	It should be set up when adding device value at the end of character string.
	Date and time	It should be set up when adding date and time to the file names. Check the items to be added from Year, Month, Day, Hour, Minute and Second.
	Preview	To preview the set file names.

● In case transfer object is "device" and transfer operation is "GET <download>"

When downloading the files with device values written in and writing devices, the data files in FTP server should be specified.



Item	Description
Connection destination FTP server	To select from the set FTP server.
Transfer object	To select the transfer object from file and device. (default setting: file)
Transfer operation	To select as PUT <upload> or GET <download>files. (Default value: PUT)
Transfer source file	Users may log in FTP server and the relative path of the root directory is used to specify transfer source files. Maximum 248 half-width characters can be set. Wildcard (*, ?) can be used in file name.
When transfer is successful, delete transfer source file	If checked, the files in FTP server will be deleted upon successfully getting files from FTP server.

● File format of device value

Device data files shall be in the following format when uploading/downloading device value.

Basic configuration

[Device name], [data], [number of words],
[Device name], [data], [number of words],
[Device name], [data], [number of words],
.
.

} Consecutive number

Example 1 for reference

DM1000,1234,1, number of productions
DM1001.5678,1, number of targets
:

Example 2 for reference

R30000,1,0, lamp
R30001.1,0, inspection start
:

Device type setting

Device type	Device name	Category
Relay	R, X, Y	Bit device
Internal auxiliary relay	MR, M	Bit device
Latch relay	LR, L	Bit device
Link relay	B	Bit device
Data memory	DM, D	Word device
Data memory*	EM, E*	Word device
File register*	FM, F*	Word device
File register (consecutive No. mode)*	ZF*	Word device
Link register	W	Word device

* EM, FM and ZF cannot be used with KV-NC1EP.

Data setting

Data format		Expression	Example
Bit device		Display 0 (ON), or 1 (OFF)	0, 1
Word device	Decimal	Display a decimal number.	1000, -100000
	Hex	Display after adding 0x at the beginning *1	0x1234, 0x12ABCDEF
	Character string	Display character string with """". *2	"""abcd""", """1234"""

*1 The value is case insensitive.

*2 When downloading, data quoted by " shall be treated as character string. For the item quoted by """", characters quoted by " can not be specified again.
(e.g.) It may not specify """A"B""".

Number of words setting

Data format	Expression	
Bit	0*1	
Value	1 word (16-bit)	1*1
	2 word (16-bit)	2
Character string	1 to 64 *1*2	

*1 When downloading, it can be omitted in device data files.

*2 When downloading, if the character string is shorter than the specified number of words of device data files, the rest words shall be written as 0.

Examples of valid device data file format in downloading

Example 1) for reference Add line comments

When downloading, comments with; in the leading line is ignored.

```
;Initial parameters
DM1000,1234,1, number of settings
DM1001.5678,1, number of targets
```

Example 2) Specify multiple devices

Different device types can be specified in one file. When downloading, values are written in various types of device. Maximum number of settable devices is 10,000.

```
;Initial parameters
DM1000,1234,1, number of settings
R30000,1,0, lamp
EM2000,"""test""",2, item
:
```

Reference When inputting [device name], [data], [number of words] and [comments], the half-width space and Tabs in front of each value are ignored.

Device Used in FTP File Transfer

Relays and buffer memories used in FTP file transfer function are as follows.

■ Relay

n : Leading relay No.

Relay No.	Name	Function	R/W
n +2000	FTP file transfer req ID0	To execute FTP file transfer ID0 to ID9 at rising edge. *1	W
n +2001 to 2009	FTP file transfer req ID1 to 9		W
n +2010 to 2015	Reserved for system	Unavailable	-
n +2100	FTP file transfer interrupt ID0	To interrupt FTP file transfer ID0 to 9 at rising edge.	W
n +2101 to 2109	FTP file transfer interrupt ID1 to 9.		W
n +2110 to 2115	Reserved for system	Unavailable	-
n +2200	Log/trace FTP trans enable ID0.	In case transfer control is enabled, logging/ tracing FTP transfer of each logging ID is available if the relay is ON. In case transfer control is disabled, logging/ tracing FTP transfer is always available.	W
n +2201 to 2209	Log/trace FTP trans enable ID1 to 9		W
n +2210 to 2215	Reserved for system	Unavailable	-
n +3000	FTP file transfer end ID0	It will be ON after requested FTP file transfer ID0 to 9 is completed. It will also be ON in case of interrupted or in case error occurs in transfer result. It will be OFF if FTP file transfer request relay or FTP file transfer interrupt request relay is OFF.	R
n +3001 to 3009	FTP file transfer end ID1 to 9		R
n +3010 to 3015	Reserved for system	Unavailable	-
n +3100	FTP file transfer error D0	It will be ON together with complete relay if error occurs in the result of FTP file transfer ID0 to 9 or transfer is interrupted. It will be OFF if FTP file transfer request relay or FTP file transfer interrupt request relay is OFF.	R
n +3101 to 3109	FTP file transfer error ID1 to 9		R
n +3110 to 3115	Reserved for system	Unavailable	-
n +3200	Log/trace FTP transferring ID0	It will be ON during FTP transfer of logging ID0 to 9.	R
n +3201 to 3209	Log/trace FTP transferring ID1 to 9		R
n +3210 to 3214	Reserved for system	Unavailable	-
n +3215	FTP client ready for operation	After power ON or the FTP client settings is changed, it will be ON when FTP client is available.	R

*1 In case the FTP file transfer request relay of multiple IDs is ON, FTP file transfer will be executed in the sequence of relay ON.

■ Buffer memory

Address	Name	Function	R/W
1420	FTP transfer end code ID0	To store the complete results when FTP file transfer complete relay ID0 is ON.	R
1421	FTP transfer status code ID0*1	To store the status during execution of FTP file transfer ID0.	R
1422	FTP transfer progress ID0	To store the transfer progress during execution of FTP file transfer ID0 (range: 0 to 100). For situation other than FTP file transfer execution, 0 is stored.	R
1423	Reserved for system	-	-
1424	FTP transfer end code ID1	To store the complete results when FTP file transfer complete relay ID1 is ON.	R
1425	FTP transfer status code ID1*1	To store the status during execution of FTP file transfer ID1.	R
1426	FTP file transfer progress ID1	To store the transfer progress during execution of FTP file transfer ID1 (value range: 0 to 100).*2 For situation other than FTP file transfer execution, 0 is stored.	R
1427	Reserved for system	-	-
1428 to 1431	Corresponding to FTP file transfer ID2		
1432 to 1435	Corresponding to FTP file transfer ID3		
1436 to 1439	Corresponding to FTP file transfer ID4		
1440 to 1443	Corresponding to FTP file transfer ID5		
1444 to 1447	Corresponding to FTP file transfer ID6		
1448 to 1451	Corresponding to FTP file transfer ID7		
1452 to 1455	Corresponding to FTP file transfer ID8		
1456 to 1459	Corresponding to FTP file transfer ID9		

*1 Unit-specific commands for reading FTP file transfer status are available.

“U_FCSTAT "Read FTP file transfer status", page 12-30

*2 For some connection destination FTP server, transfer progress may not be displayed. In this case, 65535 (-1) is stored.

● List of FTP file transfer complete codes

Code	Description	Cause	Remedy
0	Normal	-	-
1	Transfer interrupt	Transfer is interrupted due to FTP file transfer interrupt request relay.	-
100	Invalid setting	FTP file transfer of requested transfer ID cannot be executed.	Check if the transfer ID settings specified by relay are correct.
101	No IP address assigned	No IP address is assigned.	Check the settings of "IP address setting method". Check if the setting and communication path of BOOTP server are normal.
200	Time out occurred	Communication with FTP server time out.	Check if the operation and communication path of FTP server is normal. Adjust the time out value of FTP server.
201	Login fail	Login to FTP server is failed.	Check if the login name and password are correct.
202	Logout fail	Logout to FTP server is failed.	Check the time out value setting of FTP server.
203	FTP server file read fail	Reading file from FTP server is failed.	Check if the specified file name and setting are correct.
204	FTP server file write fail	Writing file to FTP server is failed.	Check if the FTP server is writable.
205	FTP server folder read fail	Reading folder information from FTP server is failed, or no file matched with wildcard is found in the folder.	Check if the specified folder name and setting are correct.
206	FTP server folder creation fail	Folder creation in FTP server is failed, or folder is unusable.	Check if the FTP server is writable, or if the specified folder is usable.
207	Transfer mode switching fail	Switching the transfer mode of FTP server is failed.	Check if the FTP server supports the specified transfer mode.
208	GET communication error	Unexpected error occurs when writing/reading FTP server file.	Adjust the time out value of FTP server.
209	PUT communication error		
210	Communication error on getting folder information		
211	Communication error on folder creation		
212	FTP server file auto-delete fail	Deleting file is failed upon successful downloading from FTP server.	Check if the files on FTP server are read only. Check if the access authority to FTP server is read only.
213	Invalid FTP server address	Specifying FTP server address via DNS is failed.	Check FTP server address. Check the settings of DNS server.
300	Memory card access time out	Time out occurred when accessing memory card.	If the access times to memory card are too many, please reduce the times.
301	Memory card file read fail	Reading file from memory card is failed.	Check if the memory card is inserted correctly, or if the cover is closed.

Code	Description	Cause	Remedy
302	Memory card file write fail	Writing file to memory card is failed.	Check if the memory card is inserted correctly, or if the cover is closed. Check if the memory card write is locked, or if there is free space.
303	Memory card folder read fail	Reading folder information from memory card is failed.	Check if the memory card is inserted correctly, or if the cover is closed. Check if the specified folder name and setting are correct.
304	Memory card folder creation fail	Folder creation in memory card is failed.	Check if the memory card is inserted correctly, or if the cover is closed. Check if the memory card write is locked, or if there is free space.
305	Memory card file auto-delete fail	Files cannot be deleted after they are uploaded to FTP server successfully.	If the access times to memory card are too many, reduce the times.
400	No file to transfer	No file is matched to specified wildcard.	Check the settings.
401	Number of files matched with wildcard over	After wildcard is specified, the number of matched files exceeds 1,000.	Check the settings.
402	Too many folder levels created	Folder levels created exceed the upper limit.	Recreate the folder.
403	File/path name too long	File name exceeds 248 characters when uploading device. The total length of path and file name is more than 248 characters when uploading/downloading files or downloading devices.	Check device specifying, and date and time specifying of the file name, as well as wildcard setting. The length of file name or path + file name should be no more than 248 characters.
404	Device read error	Reading device is failed when uploading device.	Check device type and No..
500	Device data file - Incorrect format [device name]	Downloading is failed since device data file contains incorrect device name.	Check the device name of device data files.
501	Device data file - Incorrect format [data]	Downloading is failed since device data file contains incorrect device value.	Check the device value of device data files.
502	Device data file - Incorrect format [number of words]	Downloading is failed since device data file is out of range, or contains incorrect data character string.	Check the data character string of device data files.
503	Device data file - Unsupported device type	Downloading is failed since unavailable device type exists in device data files.	Use the device available in current PLC model. Check the device name of device data files.
504	Device data file - Device No. out of range	Downloading is failed since the device No. of device data file is out of range.	Check the device No. of device data files.
505	Device data file - Data out of range	Downloading is failed since the device value of device data file is out of range.	Check the device value of device data files.

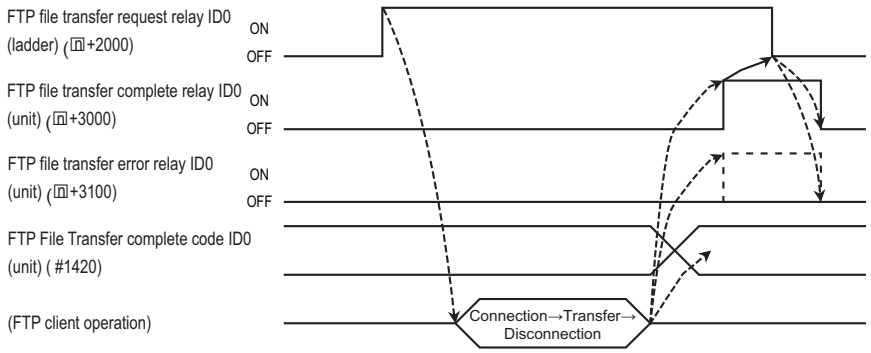
Code	Description	Cause	Remedy
507	Device data file - Number of device information over	Downloading is failed since the number of device information of device data file exceeds 10,000.	Check the number of devices of device data files.
508	Device data file - Illegal characters	Downloading is failed since device data file contain unallowable characters.	Check the characters used in device data files.
509	Device data file - Incorrect [other]	Downloading is failed since device data file contain other illegal format.	Check if the format of device data file is correct.

● List of FTP file transfer status codes

Transfer status	Status	Description
0	Stop in progress	No FTP file transfer is executed.
1	Transfer ready in progress	The status after accepting FTP file transfer request, but before starting file transfer. It includes login process to FTP server and list generation process upon specifying wildcards (*, ?).
2	Transfer in progress	FTP file transfer is being executed now. *1
3	Retry interval wait in progress	The status prior to next retry since FTP file transfer is failed.
4	Waiting in turn	The status waiting for complete of other FTP file ID transfer, or logging/tracing transfer.

*1 When getting device, it is in transferring status before complete of reading device in CPU unit.

Steps of FTP File Transfer



(1) Set the FTP file transfer request relay to "ON".

(2) The FTP file complete relay is "ON" after the completion of FTP file transfer. *

(3) Set the FTP file transfer request relay to "OFF" after checking that the FTP file transfer complete relay is "ON".

(4) The FTP file transfer complete relay will change to "OFF" if the EtherNet/IP Unit detects that the FTP file transfer request relay is "OFF".

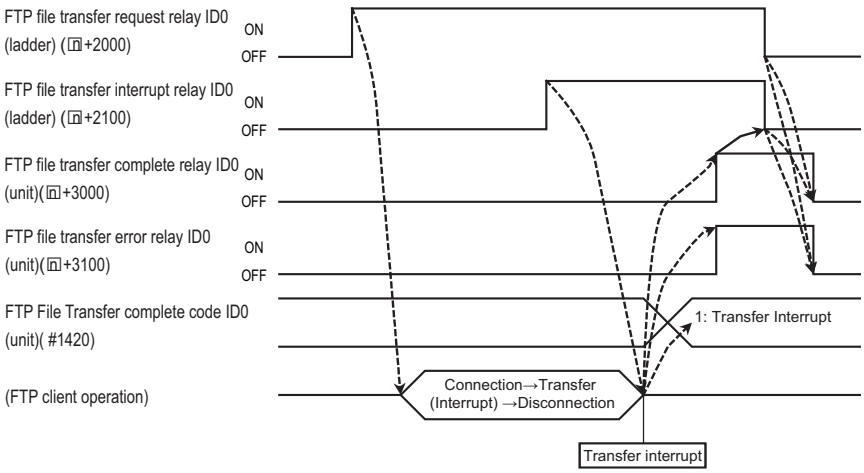
* The FTP file transfer complete relay will be "ON" if errors occur during FTP file transfer.
If the FTP file transfer error relay is "ON", the FTP file transfer complete code in the buffer memory will be read to solve the errors.

Precautions on FTP file transfer

FTP file transfer may not be executed if the FTP file transfer request relay is set to "OFF" before starting FTP file transfer.

From the beginning of FTP file transfer to the time when the FTP file transfer complete relay is "ON", FTP file transfer can still be executed even if the FTP file transfer request relay is set to "OFF.

Steps of FTP File Transfer Interrupt



(1) Set the FTP file transfer request relay to "ON".

(2) Set the FTP file interrupt request relay to "ON" during FTP file transfer.

(3) In case FTP file transfer is interrupted, "1: Transfer Interrupt" will be stored in the FTP file transfer complete code, and the FTP file transfer complete relay and the FTP file transfer error relay will be "ON".

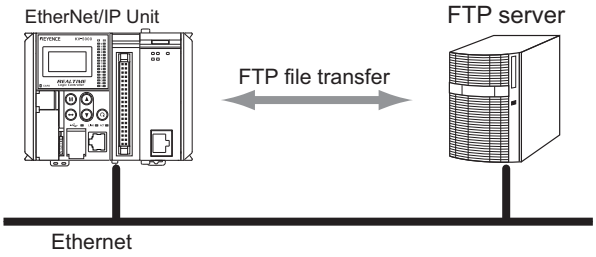
(4) Set the FTP file transfer request relay or the FTP file transfer interrupt relay to "OFF" after checking that the FTP file transfer complete relay (or the FTP file transfer error relay) is "ON".

(5) The FTP file transfer complete relay and the FTP file transfer error relay will change to "OFF" if the EtherNet/IP Unit detects that the FTP file transfer request relay and the FTP file transfer interrupt relay are "OFF".

Program for FTP File Transfer

The following describes the sample program used for FTP file transfer between EtherNet/IP Units and PCs.

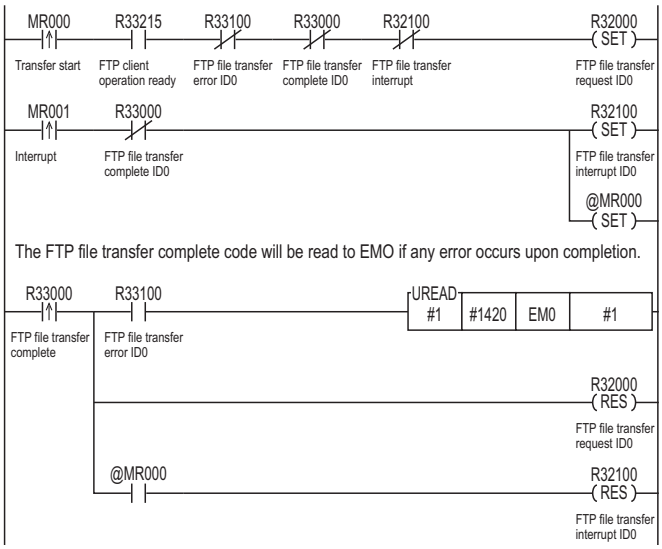
■ System configuration



Settings in Unit Editor

Setting item	Description
Extended function	Enable
Leading DM No.	10000
Leading relay No.	30000

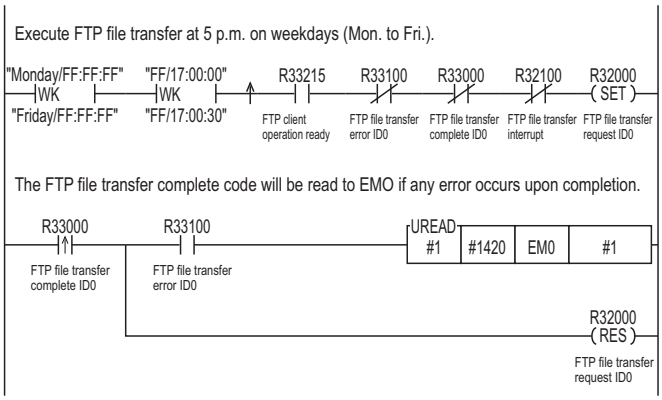
● Sample program of FTP file transfer and interrupt



(Mnemonic list)

```
LDP MR000
AND R33215
ANB R33100
ANB R33000
ANB R32100
SET R32000
LDP MR001
ANB R33000
SET R32100
SET @MR000
LDP R33000
MPS
AND R33100
UREAD #1 #1420 EM0 #1
MRD
RES R32000
MPP
AND @MR000
RES R32100
```

● Sample program of FPT file transfer at specified time

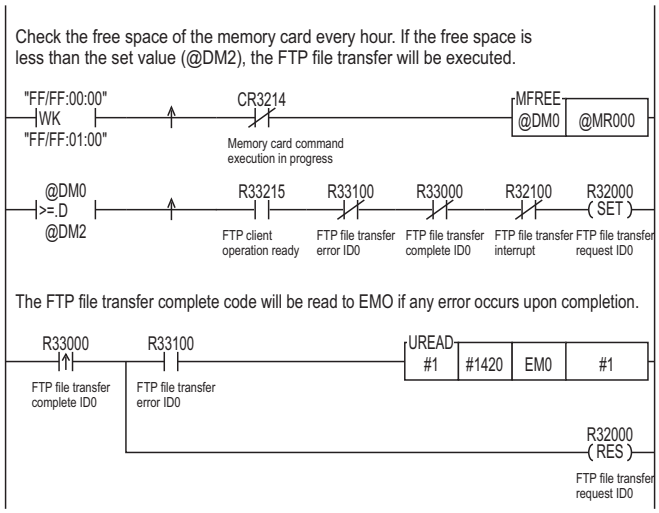


(Mnemonic list)

```
LDWK "Monday/FF:FF:FF" "Friday/FF:FF:FF"
ANDWK "FF/17:00:00" "FF/17:00:30"
MEP
AND R33215
ANB R33100
ANB R33000
ANB R32100
SET R32000
LDP R33000
MPS
AND R33100
UREAD #1 #1420 EM0 #1
MPP
RES R32000
```

Reference The time can be specified with weekly contact command.

● Sample program of FTP file transfer when checking the free space of memory card



(Mnemonic list)

```
LDWK "FF/FF:00:00" "FF/FF:01:00"
MEP
ANB CR3214
MFREE @DM0 @MR000
LD>=.D @DM0 @DM2
MEP
AND R33215
ANB R33100
ANB R33000
ANB R32100
SET R32000
LDP R33000
MPS
AND R33100
UREAD #1 #1420 EM0 #1
MPP
RES R32000
```

Unit-specific Commands/Functions for FTP File Transfer

The following describes the unit-specific commands for FTP file transfer used in ladder program, and the unit-specific functions for FTP file transfer used in script program.

■ Unit-specific command

Function	Command	Description	Page
Read FTP file transfer status	U_FCSTAT	To read the FTP file transfer status from the buffer memory.	12-30

■ Unit-specific functions

Function	Command	Description	Page
Read FTP file transfer status	U_FCSTAT	To read the FTP file transfer status from the buffer memory.	12-32

U_ FCSTAT

U_FCSTAT (.U)



@U_ FCSTAT

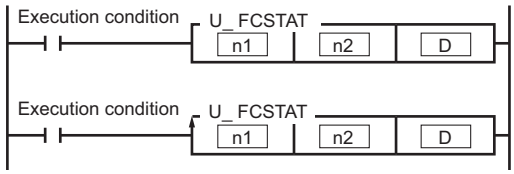
@ U_FCSTAT (.U)



Read FTP file transfer status

To read the FTP file transfer status from the buffer memory.

Ladder program



Input method

U _ F C S T A T ␣ n1 ␣ n2 ␣ D ↵

@ U _ F C S T A T ␣ n1 ␣ n2 ␣ D ↵

Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	○	–	–	–	–
n2	○	–	○	–	–	–	○	○	○*3	○	○	○	○	○	○	○	–	○	○	○
D	○	–	○	–	–	–	○	○	○*3	○	○	–	–	–	○	–	–	○	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
n2	*1 To specify the file transfer ID (0 to 9), or the device which stores the ID.
D	*2 To specify the device used for storing the read FTP file transfer status.

*1 If bit device is specified by n2, consecutive 64 bits will be processed. If any relay (R002, R106, R1012 etc) other than leading relay of the channel is specified, 16 bits will be processed by crossing over to the next channel.

*2 If bit device is specified by D, consecutive 64 bits will be processed. If any relay (R002, R106, R1012 etc) other than leading relay of the channel is specified, 64 bits will be processed by crossing over to the next channel.

*3 EM, FM and ZF cannot be used with the KV Nano Series.

Operation Description

U_FCSTAT When the execution condition is "ON", read the FTP file transfer status of file transfer ID n2 from the n1 unit, and store it in 4 words leading with D.

	Buffer memory address	Device No.
FTP file transfer status	#1420+ 4 x n2 to #1423+4 x n2	D to D+3

D	FTP file transfer complete code
D+1	FTP file transfer status code
D+2	FTP file transfer progress
D+3	0(reserved for system)

@U_ FCSTAT At the rising edge of execution condition, scanning is executed once only.

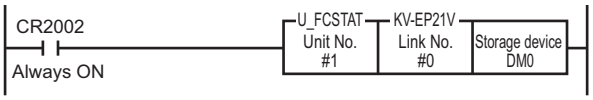
Operation flag

CR2009	Not change
CR2010	Not change
CR2011	Not change
CR2012	It will be ON if any of the following conditions is satisfied, otherwise, it will be OFF. • The unit No. specified by n1 is out of range. • The unit with the unit No. specified with n1 is not KV-5500, KV-EP21V, KV-5000, KV-LE21V, KV-LE20V or KV-NC1EP. • In case of the file transfer ID specified by n2 > 9 • In case 4 words of device cannot be ensured from the device No. specified by D • The range of indirect specifying, or index modification is inappropriate

* If CR2012 is ON, command is not executed.
KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.
"KV-5500/5000/3000 Series User Manual"
"KV Nano Series User's Manual"

Sample Program

Always read the FTP file transfer status of the FTP transfer ID0 from the buffer memory, and store it to DM0 to DM3.



(Mnemonic list)

```
LD CR2002
U_FCSTAT #1 #0 DM0
```

U_FCSTAT Read file transfer status

U_FCSTAT ([Execution condition]*1, Unit No., File transfer ID, Save destination device No.)

Argument/return value		Description	Operation type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n1	Unit No.*2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	–	–	–	–	–	–	–	–	○	–	○
n2	File transfer ID*4	To specify the file transfer ID (0 to 9), or the device which stores the ID.	.U	.U	.U	.U	–	–	–	–	○	○	○
D	Save destination device No. *3*5	To specify the device No. used to store the read FTP file transfer status.	.U	.U	.U	.U	–	–	–	–	–	○	–
R	Return value	None	–	–	–	–	–	–	–	–	–	–	–

*1 Content in [ ] can be omitted. (if execution condition is omitted, the command is always executed (every scanning).)

*2 $ cannot be used (specify hex number).

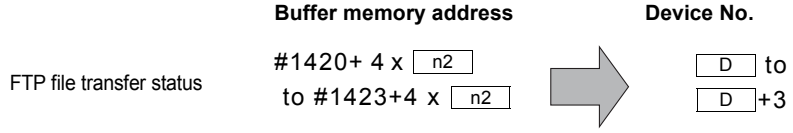
*3 CTC, CTH, and Z cannot be specified.

*4 If bit device is specified by n2, consecutive 16 bits will be processed. If any relay (R002, R106, R1012 etc) other than leading relay of the channel is specified, 16 bits will be processed by crossing over to the next channel.

*5 If bit device is specified by D, consecutive 64 bits will be processed. If any relay (R002, R106, R1012 etc) other than leading relay of the channel is specified, 64 bits will be processed by crossing over to the next channel.

Operation Description

U_FCSTAT When the execution condition is "ON", read the FTP file transfer status of file transfer ID n2 from the n1 unit, and store it in 4 words leading with D.



D	FTP file transfer complete code
D +1	FTP file transfer status code
D +2	FTP file transfer progress
D +3	0 (reserved for system)

● Format example

Script Programming

```
U_FCSTAT(MR0,1,0,DM0)
```

Operation description

When MR000 is "ON", store the FTP file transfer status of FTP file transfer ID0 of the first connected unit to DM0 to DM3.

Ladder conversion

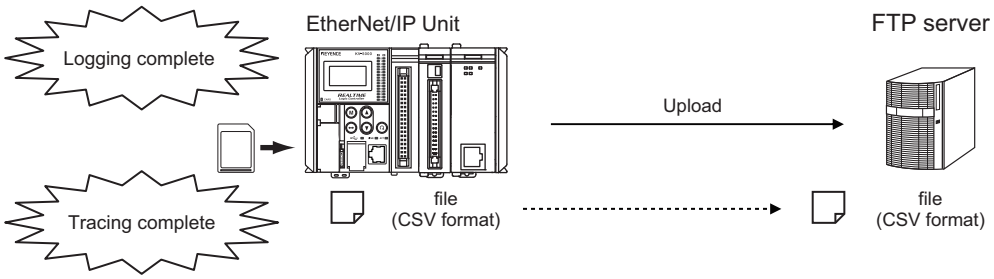


12-4 Logging/Tracing Transfer

This section describes the logging/tracing transfer.

Logging/Tracing Transfer Overview

Any logging/tracing file generated will be checked every second. If a file is generated, it will be uploaded to the FTP server.
If there are multiple result files of logging/tracing, the latest one will be uploaded. For the details of logging/tracing function, see "KV-5500/5000/3000 User's Manual", or 🕮 "KV Nano Series (connector type) User's Manual".



Necessary Setting of Logging/Tracing Transfer

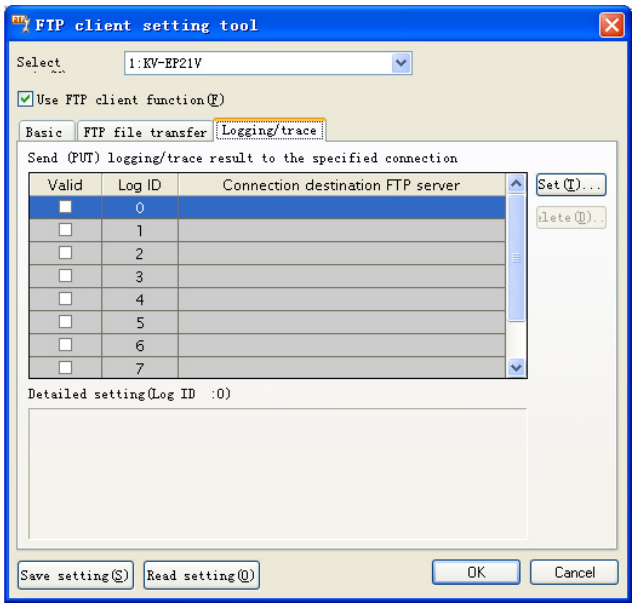
The following describes the necessary setting of the logging/tracing transfer.

For common setting of FTP client (such as FTP server setting), see " Starting FTP Client Setting Tool", page 12-6.

■ Logging/tracing (Tab)

This tab allows to display the setting of logging/tracing transfer of each ID.

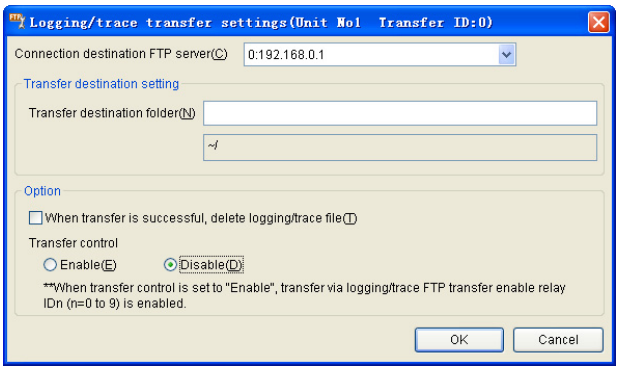
The logging/tracing transfer can be set up for at most 10 IDs.



Item	Description
Valid	If checked, only the logging/tracing transfer which corresponds to the log ID of the selected logging setting is valid. If the logging/tracing transfer is not set up, the dialog box of logging/tracing transfer setting will be opened by double-click it.
Log ID	The log ID of logging setting.
Connection destination FTP server	To display the set FTP server.
Set	To open the dialog box of logging/tracing transfer setting of the selected log ID.
Delete	To delete the logging/tracing transfer setting of the selected log ID.

■ Logging/tracing transfer setting dialog box

The relay used for logging/tracing transfer is as follows.



Item		Description
Connection destination FTP server		To select from the set FTP server.
Transfer destination setting		After logging in the FTP server, the relative path of the root directory is used to specify the transfer destination folder. Maximum 248 half-width characters can be set. *1
Option	When transfer is successful.delete logging/trace file	If checked, the files in the memory card of the CPU unit will be deleted when logging/tracing files are successfully put to the FTP server.
	Transfer control	If transfer control is enabled, the logging/tracing FTP transfer enable relay can be used to stop the logging/tracing transfer from the ladder against every log ID. "Device Used for Logging/Tracing Transfer", page 12-36(Default Value: invalid)

*1 For characters unallowable in folder name, see "Precautions on FTP client setting", page 12-4.

Device Used for Logging/Tracing Transfer

The relays and buffer memories used for logging/tracing transfer are shown below.

■ Relay

n : Leading relay No.

Relay No.	Name	Function	R/W
n +2200	Log/trace FTP trans enable ID0.	When the "Transfer control" of "Logging/tracing transfer setting" is set to "Enable", FTP file transfer of log ID0 to 9 will be available if the relay is "ON".	W
n +2201 to 2209	Log/trace trans enable ID0 to 9		W
n +2210 to 2215	Reserved for system	Unavailable	-
n +3200	Log/trace FTP transferring ID0	The relay will be "ON" during execution of logging/tracing transfer ID0. The relay will be "OFF" upon the completion of Logging/tracing transfer.	R
n +3201 to 3209	Log/trace FTP transferring ID1 to 9	The relay will be "ON" during execution of logging/tracing transfer ID1 to 9. The relay will be "OFF" upon the completion of Logging/tracing transfer.	R
n +3210 to 3215	Reserved for system	Unavailable	-

12-5 Other Functions

This section describes other functions related to FTP client function.

Check the Log of FTP Client Function

FTP client function can be used to save as many as 30 latest upload/download logs of FTP server in the CPU unit, and these logs can be checked with the unit monitor of KV STUDIO.

■ Log details

The log details are as follows.

- Date (Example: "2009/09/10")
- Time (Example: "12:34:56")
- Connection destination FTP server (Example: "ftpserver" or "192.168.0.100")*1
- Operation<transfer object, transfer operation>
  (examples: "PUT file")
- File transfer (Example: "device.csv")*1*2
- Error details<FTP file transfer complete code and details>
  (Example: "(0) normal")

*1 32 half-width characters at most can be displayed.
In case the number of characters is more than 32, the first 32 characters will be displayed with "...".

*2 The transferred file name is displayed, but the specified folder name is not displayed.

MEMO

13

SIMPLE PLC LINK FUNCTION

This chapter describes how to build data link by using simple PLC link function.

13-1 Simple PLC Link Function Overview 13-2
13-2 Setting of Simple PLC Link Function 13-16
13-3 Device and Command of Simple PLC Link Function
. 13-20

13-1 Simple PLC Link Function Overview

This section gives a general description to the simple PLC link function.

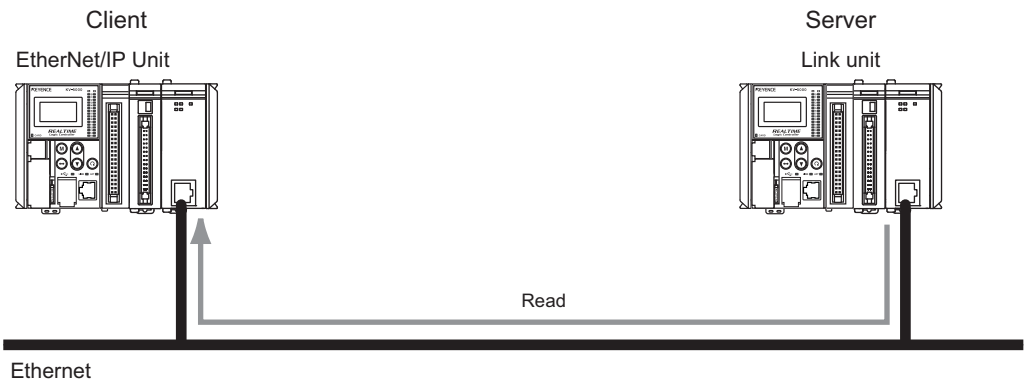
Simple PLC Link Function Overview

With the simple PLC link function, data send/receive between EtherNet/IP Units and link units is available only by setting up the number of devices and data to be linked with the simple PLC link setting tool, and a ladder program is not required.
32 data links at most can be set up.

■ Data send/receive (TXD/RXD) pattern using simple PLC link function

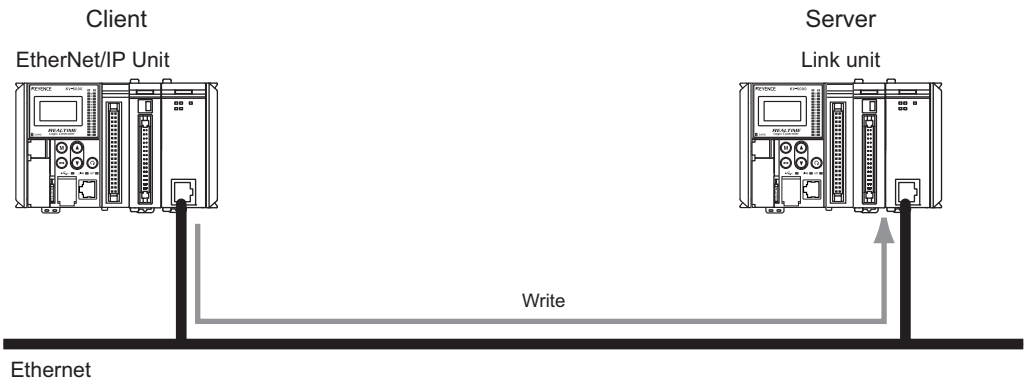
● Read

The link unit data is read to the EtherNet/IP Unit (local station).



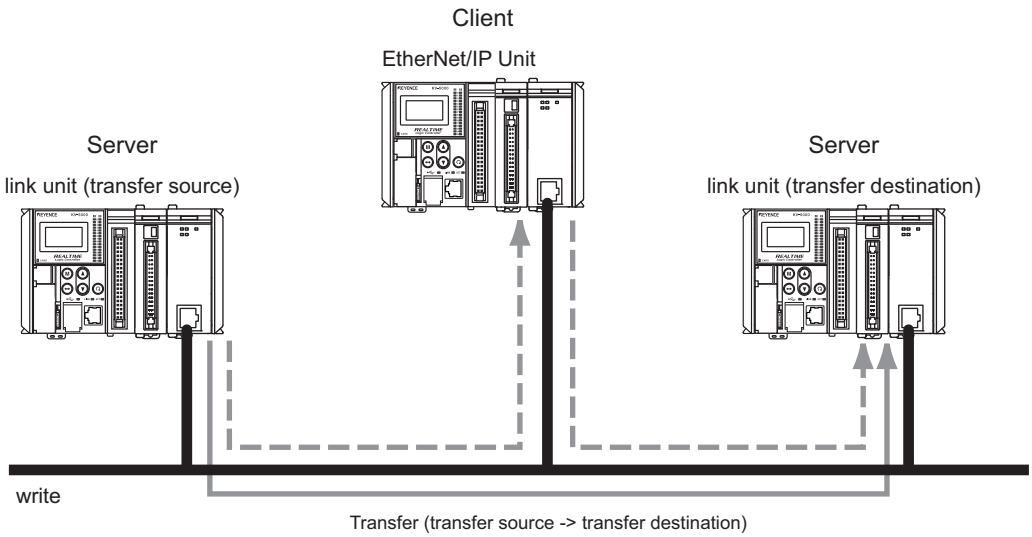
● Write

The EtherNet/IP Unit data (local station) is written into the link unit.



● Transfer

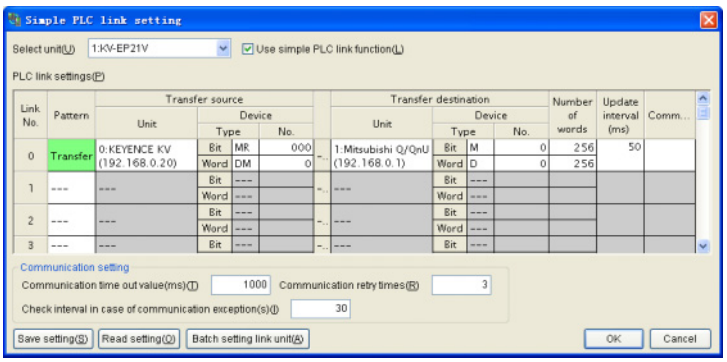
The data is written from the link unit (transfer source) into the link unit (transfer destination).
Within the same network, the EtherNet/IP Unit (local station) where the data link has been set, should be included.



Reference When the transfer is set, the EtherNet/IP Unit (local station) reads the data from the transfer source and writes it into the transfer destination, therefore the ladder program for data link is not required for the link unit.

Simple PLC Link Setup Tool

The setting tool is used to set up the built-in PLC link in the ladder support software KV STUDIO.
"Startup and Default Setting of Simple PLC Link Setup Tool", page 13-17



Specification of Simple PLC Link Function

■ Specification of simple PLC link

Item	Description
Number of settings	Up to 32 settings
Data size	Up to 256 words/setting, and up to 2048 words/total setting
Data unit	1 words
Update interval	10 to 65535ms

■ Communication specification of simple PLC link

The EtherNet/IP Unit (local station) adopts MC protocol communication to send/receive data.

Item	Description
Communication mode	UDP
Service port No.	EtherNet/IP Unit (local station): 5001 (default value: changeable) Link unit: 5000 (default value: individually changeable)
Number of slots	1
Supported frame	Qna compatible 3E frame*1 A compatible 1E frame*2
Communication data code	Binary code
Used command	Batch read [word], batch write [word]

*1 When the link unit is set to KEYENCE KV, or Mitsubishi Q/QnU

*2 When the link unit is set to Mitsubishi A

Supported Link Units and Necessary Settings

■ List of supported link units

Link unit setting	Manufacturer	CPU	Communication unit	Setting
KEYENCE KV	KEYENCE	KV-3000	KV-LE20V KV-LE21V KV-EP21V	13-6
		KV-5000	- (Built-in)	13-6
		KV-5500	- (Built-in)	13-6
		KV-NC32T KV-N60** KV-N40** KV-N24**	KV-NC1EP	13-7
MITSUBISHI Q/ QnU	MITSUBISHI	Q Series QnN Series	QJ71E71(-100)	13-7
		QnUDE(H) Series QnUV Series	- (Built-in)	13-8
MITSUBISHI A	MITSUBISHI	AnS Series	A1SJ71E71N3-T	13-9

■ Necessary link unit setting

● KV-5500 built-in EtherNet/IP port setting

The built-in EtherNet/IP port of KV-5500 can be set up in the Unit Editor.

Item	Setting
IP address	To set up IP address of link unit.
MC protocol port No. (UDP)*1	In the simple PLC link setting, the port No. shall be identical to the MC protocol communication port No. set to the link unit.
MC protocol communication code	To set to a binary code.

*1 The default value can be used for communication since the default value (5000) of the MC Protocol port No. (UDP) of KV-5500 is identical to that of the link unit port No. of the simple PLC link.

● KV-5500 built-in Ethernet port setting

The built-in Ethernet port of KV-5000 can be set up in the Unit Editor.

Item	Setting
Communication mode	Ethernet (*)
IP address	To set up IP address of link unit.
MC protocol port No. (UDP)*1	In the simple PLC link setting, the port No. shall be identical to the MC protocol communication port No. set to the link unit.
MC protocol communication code	To set to a binary code.

*1 The default value can be used for communication since the default value (5000) of the MC Protocol port No. (UDP) of KV-5000 is identical to that of the link unit port No. of the simple PLC link.

● KV-EP21V setting

KV-EP21V is set up with Unit Editor.

Item	Setting
IP address	To set up IP address of link unit.
MC protocol port No. (UDP)*1	In the simple PLC link setting, the port No. shall be identical to the MC protocol communication port No. set to the link unit.
MC protocol communication code	To set to a binary code.

*1 The default value can be used for communication since the default value (5000) of the MC Protocol port No. (UDP) of KV-EP21V is identical to that of the link unit port No. of the simple PLC link.

● KV-LE21V/LE20V setting

Set KV-LE21V/LE20V on Unit Editor.

Item	Setting
Operating mode	KV-LE20V mode*2
IP address	To set up IP address of link unit.
MC protocol port No. (UDP)*1	In the simple PLC link setting, the port No. shall be identical to the MC protocol communication port No. set to the link unit.
MC protocol communication code	To set to a binary code.

*1 The default value can be used for communication since the default value (5000) of the MC Protocol port No. (UDP) of KV-LE21V/LE20V is identical to that of the link unit port No. of the simple PLC link.

*2 The MC Protocol communication is unavailable in KV-LE20A compatible mode.

● KV-NC1EP Setting

KV-NC1EP Setting

Item	Setting
IP address	To set up IP address of link unit.
MC protocol port No. (UDP)*1	In the simple PLC link setting, the port No. shall be identical to the MC protocol communication port No. set to the link unit.
MC protocol communication code	To set to a binary code.

*1 The default value can be used for communication since the default value (5000) of the MC Protocol port No. (UDP) of KV-NC1EP is identical to that of the link unit port No. of the simple PLC link.

●QJ71E71(-100) setting

QJ71E71(-100) can be set up with GX-Developer.

Reference The setting item and method of QJ71E71 is the same as those of QJ71E71-100.

Select "parameter"-"network parameter" from GX-Developer.

(1) "MELSECNET/Ethernet"

Item	Description
Network type	Select "Ethernet".
Leading I/O No.	Please set up as required.
Network No.	Please set up as required.
Group No.	Please set up as required.
Station No. mode	Please set up as required.
Mode	Select "Online".

(2) "Ethernet operation setting"

Item	Description
Data exchange code setting	Select "binary code exchange".
Initial time setting	Select "always wait in OPEN".
IP address setting*1	To set up the IP address assigned to the link unit.
Send frame setting	Select "Ethernet(V2.0)".
Enable write under RUN	Select "Enable".

*1 In the same LAN, IP address should not be duplicate with other units.
IP Address format: XXX.XXX.XXX.XXX (XXX: 0 to 255).

● QnU Ethernet built-in CPU unit setting

QnU Ethernet built-in CPU unit can be set up with GX-Developer.

Select "Parameter" - "PC parameter" - "Built-in Ethernet port setting" from GX-Developer.

Item		Description
IP address setting	IP address*1	To set up the IP address assigned to the link unit.
	Subnet mask pattern	To set up the subnet mask of the link unit.
	Default router IP address	To set up the default router IP address of the link unit.
Data exchange code setting		Select "binary code exchange".
Enable write under RUN (FTP and MC Protocol)		Select "Enable".
Disable direct connection to MELSOFT		Please set up as required.
No response to the Ethernet built-in CPU search on the network		Please set up as required.

*1 In the same LAN, IP address should not be duplicate with other units.

Press the "Open setting" button to execute "Built-in Ethernet port open setting".

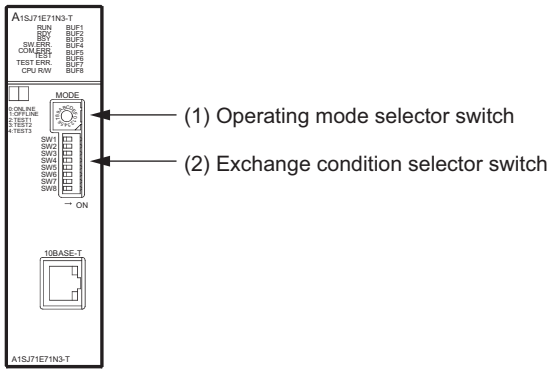
Item	Description
Protocol	Select "UDP".
Open mode	Select "MCprotocol".
Local station port No. *1	To set up PLC port No. (0401H to 1387H, 1392H to FFFEH, in the form of HEX).

*1 One port No. should be connected to one KV-EP21V. Otherwise, normal communication is unavailable.

Please disconnect the power of the CPU unit, and reconnect after setup.

■ A1SJ71E71N3-T setting

The Ethernet unit supported by AnS series from Mitsubishi can be set up.
Refer to the following table to set up each switch.



(1) Operating mode selector switch

Operating mode selector switch	Setting No.	Settings	Set value
	0	Online	0*
	1	Offline	
	2	Self-diagnosis test	
	3	RAM test	
	4	ROM test	
	5 to F	Unavailable	

* Must set to “0”.

(2) Communication condition selector switch

Exchange condition selector switch	Setting No.	Settings	Set (recommended) value	
	SW1	Communication line processing in case of TCP time out error	Close line	OFF
	SW2	Data code setting	Binary code	OFF *1
	SW3 to SW6	Unusable (fixed as OFF)	-	OFF *1
	SW7	CPU exchange time setting	Enable write	ON *2
	SW8	Initial time setting	-	Any

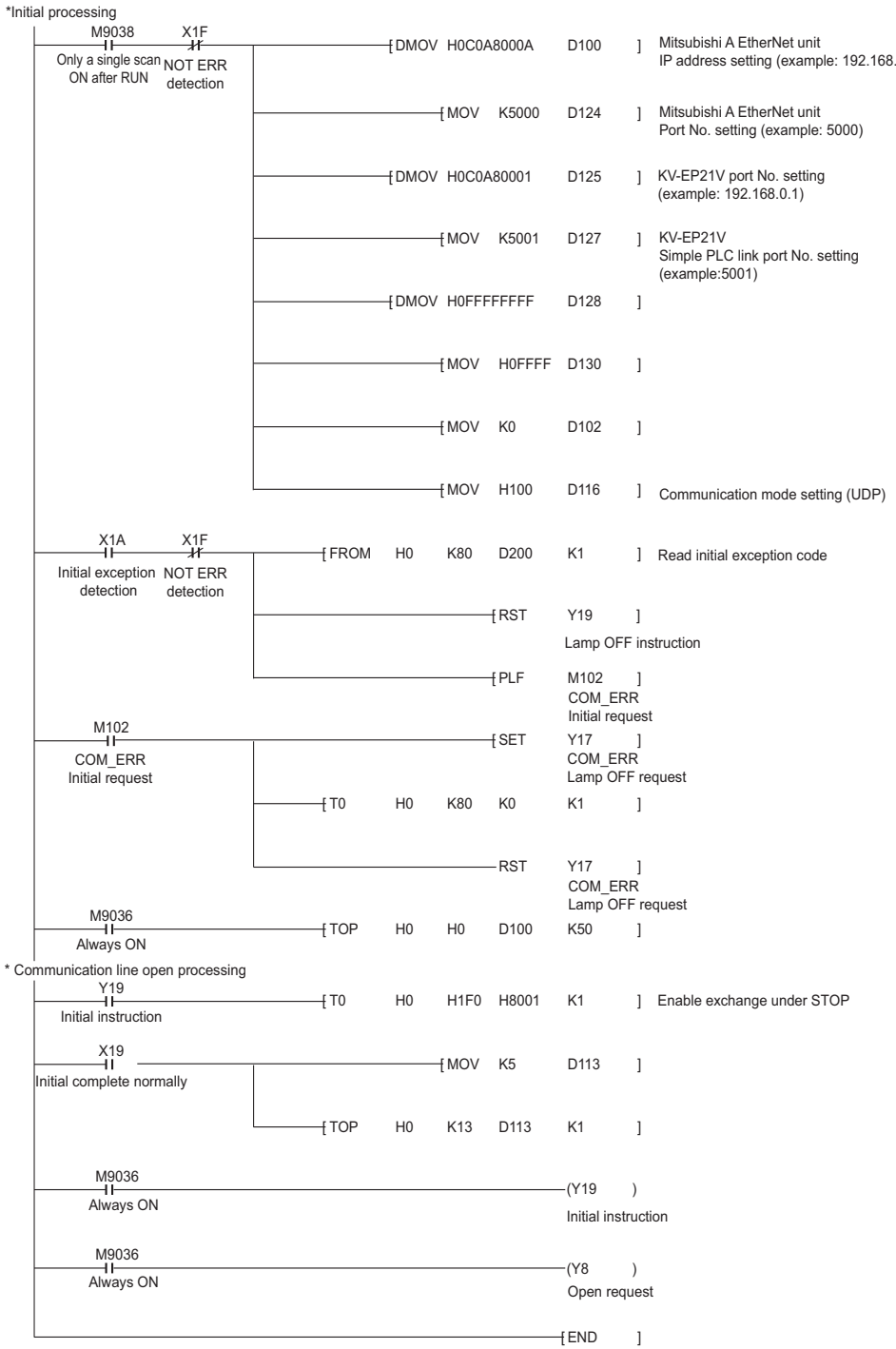
*1 It must be set to OFF.

*2 It must be set to ON when executing write under RUN.

■ Communication setting

When connecting A1SJ71E71N3T- to KV-EP21V via Ethernet, the ladder software GX Developer from Mitsubishi Electric is required to create a ladder. For the setting details, see the user's manual (details) of Ethernet interface unit supporting MELSEC-A series.

Reference ladder example



Supported Devices

The following describes the devices supported by settable link units in simple PLC link setting. For the usable devices in practical, see appropriate link unit manual.

■ Supported devices (KEYENCE KV)

● When using KV-5500 or KV-EP21V

Device type			Setting range (Leading No.)
Bit*	I/O relay	R	0 to 99900
	Internal auxiliary relay	MR	0 to 99900
	Latch relay	LR	0 to 99900
	Link relay	B	0 to 3FF0
Word	Data memory	DM	0 to 65534
	Extended data memory	EM	0 to 65534
	File register	FM	0 to 32767
		ZF	0 to 131071
	Link register	W	0 to 3FFF

* It is set up by channel.

● When using KV-NC1EP

Device type			Setting range (Leading No.)
Bit*	I/O relay	R	0 to 59900
	Internal auxiliary relay	MR	0 to 59900
	Latch relay	LR	0 to 19900
	Link relay	B	0 to 1FF0
Word	Data memory	DM	0 to 32767
	Link register	W	0 to 3FFF

* It is set up by channel.

■ Supported devices (KEYENCE KV<XYM>)

● When using KV-5500 or KV-EP21V

Device type			Setting range (Leading No.)
Bit*1	I/O relay	R	0 to 99900
	Internal auxiliary relay	M	0 to 15984*2
	Latch relay	L	0 to 15984*2
	Link relay	B	0 to 3FF0
Word	Data memory	D	0 to 65534
	Extended data memory	E	0 to 65534
	File register	F	0 to 32767
		ZF	0 to 131071
	Link register	W	0 to 3FFF

*1 It is set up by channel.

*2 It should be set to a multiple of 16. If the input is not a multiple of 16, a multiple of 16 less than the input value is set.

● When using KV-NC1EP

Device type			Setting range (Leading No.)
Bit*1	I/O relay	R	0 to 59900
	Internal auxiliary relay	M	0 to 15984*2
	Latch relay	L	0 to 3184*2
	Link relay	B	0 to 1FF0
Word	Data memory	D	0 to 32767
	Link register	W	0 to 3FFF

*1 It is set up by channel.

*2 It should be set to a multiple of 16. If the input is not a multiple of 16, a multiple of 16 less than the input value is set.

■ Supported devices (Mitsubishi Q/QnU)

Device type			Setting range (Leading No.)
Bit*1	Input relay	X	0 to 1FF0
	Output relay	Y	0 to 1FF0
	Internal auxiliary relay	M	0 to 8176*2
	Latch relay	L	0 to 8176*2
	Link relay	B	0 to 1FF0
Word	Data register	D	0 to 12287
	Link register	W	0 to 1FFF
	File register	R	0 to 32767
	Extended file register	ZR	0 to 41804063

*1 It is set up by channel.

*2 It should be set to a multiple of 16. If the input is not a multiple of 16, a multiple of 16 less than the input value is set.

■ Supported devices (Mitsubishi A)

Device type			Setting range (Leading No.)
Bit*1	Input relay	X	0 to 7F0
	Output relay	Y	0 to 7F0
	Internal auxiliary relay	M	0 to 8191, 9000 to 9255*2
	Link relay	B	0 to FF0
Word	Data register	D	0 to 8511
	Link register	W	0 to FFF
	File register	R	0 to 8191

*1 It is set up by channel.

*2 It should be set to a multiple of 16. If the input is not a multiple of 16, a multiple of 16 less than the input value is set.

Precautions on using Simple PLC Link

The following describes the precautions on using simple PLC link function to build data link.

■ PROG communication

Even through the CPU unit is in program status, simple PLC link communication is executed.

■ Action in case of communication error

● Auto communication restore

In case of communication error, communication is continued according to the survival confirmation interval period, therefore the communication will be automatically restored and data link is restarted when the error is eliminated.

● Communication with other link unit in case of communication error

When simple PLC link is simultaneously executed on multiple link units, even if a communication error occurs among some of the link units, the communication among the others is continued.

■ Data simultaneity

If the link units specified in transfer source and transfer destination are KEYENCE KV, the data of 2 words leading with the even number will be updated in the device where the link is set.

■ Data update sequence

The following describes the update sequence of the linked devices including both word device and bit device exist.

● In case of read

When reading transfer source data, the sequence is bit device -> word device.

● In case of write

When writing data in transfer destination, the sequence is word device -> bit device.

● In case of transfer

After transfer is set, the local station will read transfer source data according to the sequence of bit device -> word device and write data in transfer destination in the sequence of word device -> bit device.

Reference Bit device is used as the data update flag at transfer destination and a program is created at transfer source, so that data is stored in sequence of word device -> bit device, thus all word devices can be processed at the same time.

■ When using routers, etc.

Please do not use the function if multiple communication paths exist, such as multiple routers between the EtherNet/IP Unit and the link unit.

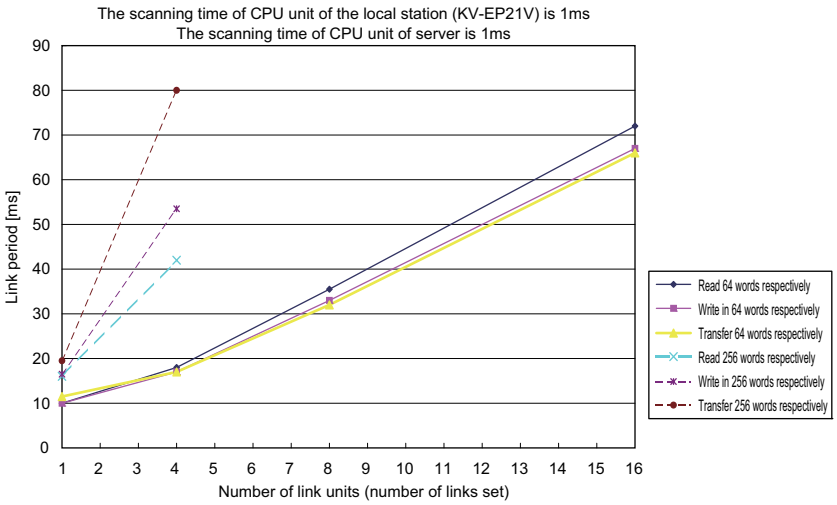
Data Update Interval

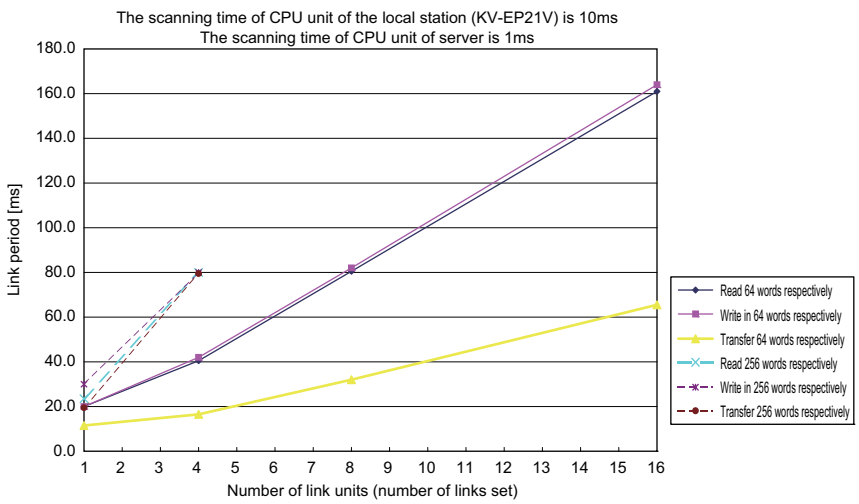
The following describes the desired value of update interval (link period) when using the EtherNet/IP Unit simple PLC link function.

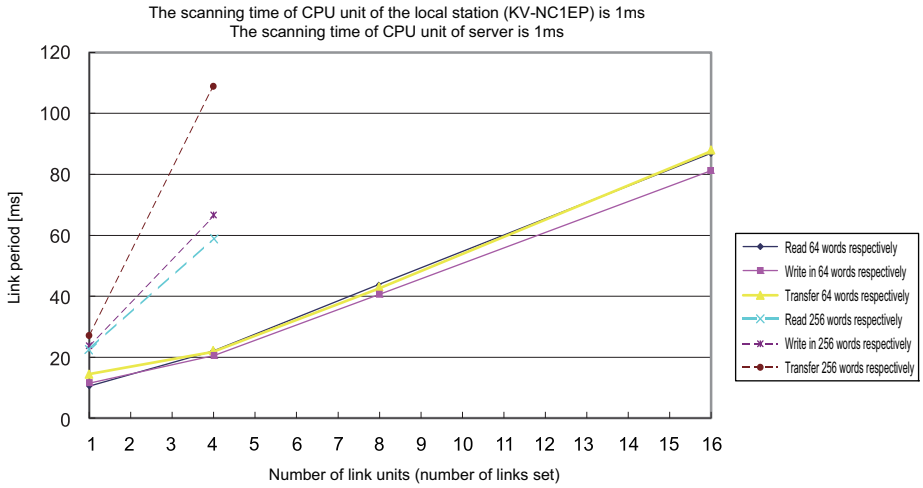
■ Data update interval

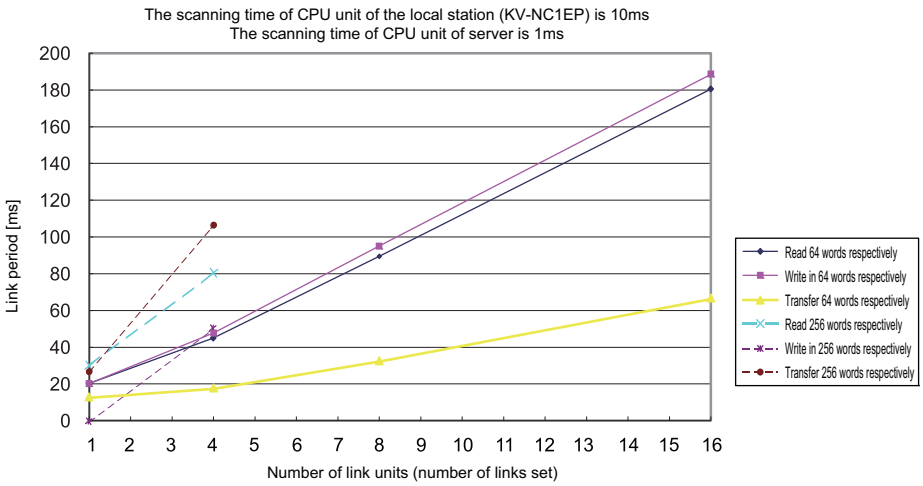
The link period of the EtherNet/IP Unit simple PLC link function depends on factors such as the number of links set, size of data transferred, scanning time of CPU unit, service condition of other functions of the EtherNet/IP Unit, response time of MC protocol server, etc.
Update interval of simple PLC link can be set up according to the graph below.
However, it may vary with network configuration and condition.
The EtherNet/IP Unit monitor can be used to check the actual link period.

The graph below expresses the relation between the number of MC protocol server units (KV-EP21V, KV-5500 or KV-NC1EP), that is number of links set, and the link period when each bit device and word device are set respectively as 64 words (128 words in total) and 256 words (512 words in total), according to transfer pattern and the scanning time of CPU unit at client.









Reference

- When reading and writing data, even the set update interval is quite short, the actual link period will exceed the scanning time. When setting update interval, the set value shall be more than the scanning time.
- If multiple links are set to one MC protocol server, each data link is executed in sequence. Therefore, data update time of each set link count will exceed the value in the graph when multiple links are set.
- If the communication response time and scanning time of MC protocol server are long, data update interval will be longer than the value in the graph.
- In case both bit device and word device are set in a link setting, transfer of word device and bit device are executed in turn. Therefore, the data update time of link setting will be approximately half of the value in the graph if only bit device or word device is set.

13-2 Setting of Simple PLC Link Function

This section describes necessary setting when using simple PLC link function.

Check Settings in Unit Editor

When using the EtherNet/IP Unit simple PLC link function, the settings of Unit Editor shall be checked to ensure it corresponds with the following conditions. If the settings do not meet the following conditions, please use Unit Editor to change the settings. For the setting method, see"3-1 Unit Editor Setting", page 3-2.

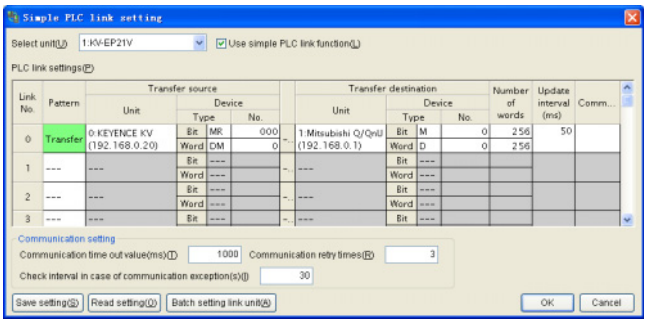
Item	Settings	Setting range	Default value	See page
Extended function	To set to “Enable”.	Enable/Disable	Disable	3-6
Leading DM No.	To set up a No. not used in other purposes.	0 to 65518	To be set up	3-6
Number of used DMs	Number of DMs used by the unit	16	16	-
Leading relay No. (ch unit setting)	To set up a No. not used in other purposes.	10 to 960	To be set up	3-6
Number of relays in use	Number of relays used by the unit	640	640	-
Baud rate	Please set up according to the network used.	100M/10Mbps Auto/ 10Mbps	100M/10Mbps Auto	3-6
Setting method of IP address	To set up the setting method of IP address.	Fixed IP address/ BOOTP->fixed IP Auto switching/BOOTP	Fixed IP address	3-6
IP address	Please set up a IP address not duplicated with other nodes.	0.0.0.0 to 255.255.255.255	192.168.0.10	3-7
Subnet mask	Please set up appropriate subnet mask.	0.0.0.0 to 255.255.255.255	255.255.255.0	3-7
Default gateway	Please set up appropriate default gateway.	0.0.0.0 to 255.255.255.255	0.0.0.0	3-7
Routing setting	Please set up as required.	Yes/Disable	Disable	3-10
Target IP address 1 to 6	Please set up as required.	0.0.0.0 to 255.255.255.255	0.0.0.0 (Disable)	3-10
Target subnet mask 1 to 6	Please set up as required.	0.0.0.0 to 255.255.255.255	0.0.0.0 (Disable)	3-10
Router IP address 1 to 6	Please set up as required.	0.0.0.0 to 255.255.255.255	0.0.0.0 (Disable)	3-10
Simple PLC link port No.	Change as required.	1 to 65535	5001	3-9

Startup and Default Setting of Simple PLC Link Setup Tool

The settings relevant to simple PLC link function can be executed with KV STUDIO.

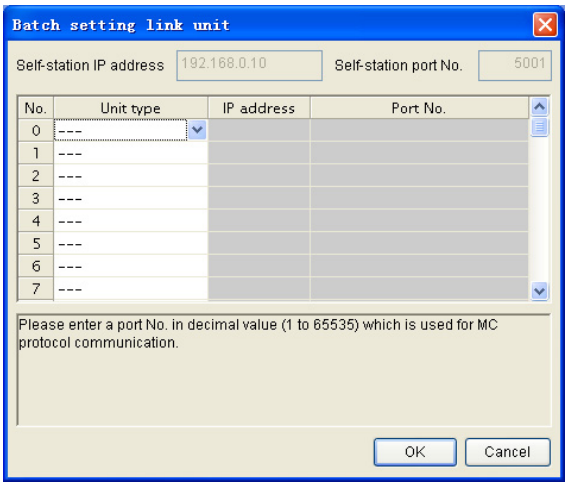
The following ways are available to open the setting window.

- Select [Tool(T)] -> [Simple PLC link setting(M)] from menu in turn.
- Click button
- Click simple PLC setting in Unit Editor
- Click " " button in Unit Editor



Item	Description
Select unit	To select the unit required for simple PLC link function setting.
Use Simple PLC link function	To select to use simple PLC link function.
Save settings	To save the setting after a file is specified.
Read settings	To read the setting after a file is specified.
Batch setup link unit	To set up the link units used in other windows in batch.

Batch setup link unit

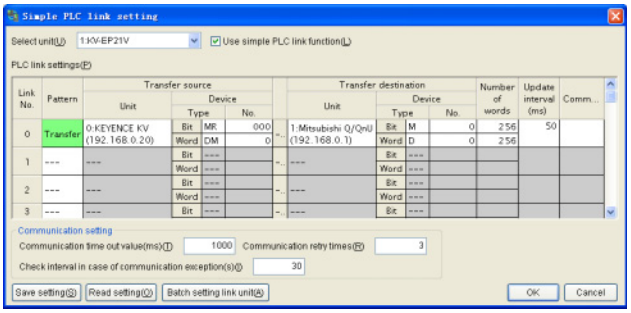


Item	Description
Unit type	To set up the link unit as KEYENCE KV, Mitsubishi Q/QnU or Mitsubishi A.
IP address	To set up IP address of link unit.
Port No.	To set up MC protocol communication port No. of link unit.

PLC Link Setting

The data link of each link No. should be set up.

■ PLC link setting (Link No. 0 to 31)



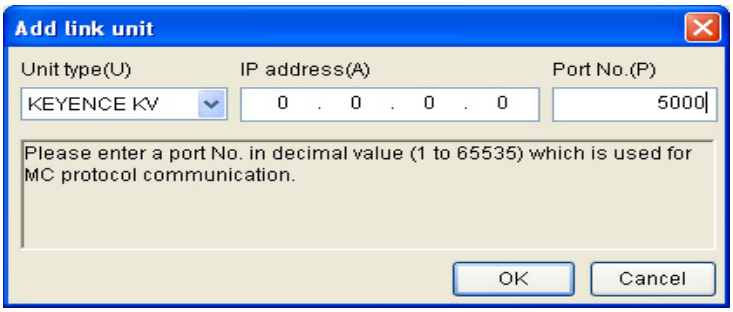
Item	Description	
Pattern	To set up data link way of each link No., as read, write, or transfer.	
Transfer source*1/ Transfer destination *2	Unit	To select whether to add link units in the batch link unit setting.
	Device type	To set up according to the set link units.
	Device No.	"Supported Devices", page 13-11
Number of words	To set up the number of data links by word. (Range: 1 to 256). (totally 2048 words in link setting)	
Update interval (ms)*3	To set up the minimum communication interval. (Range: 10 to 65535). Default value: 100 (ms)	
Comments	32 half-width characters (16 full-width characters) at most	

*1 The local station (EtherNet/IP Unit) will be set to transfer source automatically when selecting write.

*2 The local station (EtherNet/IP Unit) will be set to transfer destination automatically when selecting read.

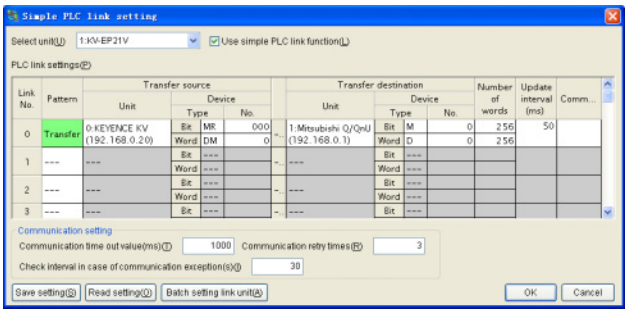
*3 Influenced by scanning time and communication load, values set with actual update period are valid under the following circumstances.

Add link unit



Item	Content
Unit type	To set up the link unit as KEYENCE KV, Mitsubishi Q/QnU or Mitsubishi A.
IP address	To set up IP address of link unit.
Port No.	To set up MC protocol communication port No. of link unit.

Communication Setting



Item	Description
Check interval in case of communication exception(s)	To set up the communication interval of link units before PLC link or after failure of communication. (Range: 1 to 300). Default value: 30 (s)
Communication time out value (ms)	To set up communication time out value (Range: 10 to 65535). Default value: 1000 (ms)
Communication retry times	To set up communication retry times (Range: 0 to 255) Default Value: 3 (times)

Reference Communication settings of all link settings are in common use. Communication setting to each link No. respectively is not allowed.

13-3 Device and Command of Simple PLC Link Function

This section describes device, unit-specific command and ladder program used in simple PLC link function.

Devices Used in Simple PLC Link Function

Relays and buffer memories used in simple PLC link function are as follows.

■ Relay

n: Leading relay No.

Relay No.	Name	Function	R/W
n +2300	PLC link stop req No.0	Simple PLC link of each link ON. will stop if the relay is ON. After stopped, the PLC link in progress relay will be OFF.	W
n +2301 to 2315	PLC link stop req No.1 to 15		
n +2400	PLC link stop req No.16		
n +2401 to 2415	PLC link stop req No. 17 to 31		
n +3300	PLC link No. 0	It will be ON if PLC link is normally executed.	R
n +3301 to 3315	PLC link No. 1 to 15		
n +3400	PLC link No. 16		
n +3401 to 3415	PLC link No. 17 to 31		

● PLC link in progress relay No. 0 to 31

It will be ON if simple PLC is normally executed.

All relays will be OFF in case of power ON or simple PLC link setting change. If "write" or "transfer" is set, the relays will be ON after communication ends normally. If "read" is set, the relays will be ON after communication ends normally and reading the device of CPU unit.

In case of abnormal communication, according to the set retry times, the relays will be OFF after successive communication failure.

■ Buffer memory

Address	Name	Function	R/W
1490	PLC link communication period No. 0	To store the update period of simple PLC link.	R
1491 to 1521	PLC link communication period No. 1 to 31		
1522	PLC link status No. 0	To store the communication status of simple PLC link. For details about link status, see "PLC link status list", page 13-22.	R
1523 to 1553	PLC link status No. 1 to 31		

● PLC link period No. 0 to 31

To store data update period of each setting.

All update periods are set to 0 in case of power ON or simple PLC link setting.

It will be 0 in case of communication error.

Point

lUpdate period will be stored as 65535 (ms) if it exceeds 65535ms.

● PLC link status list

The simple PLC link communication status of each link No. should be stored in the buffer memory.

PLC link status stored in normal condition

Code	Message	Description
0	-	No simple PLC link is set up in corresponding link No..
1	Link request in progress	In set link No.s of simple PLC link, the status of communication success/ failure not confirmed after power ON/setting change.
2	Link in process	The status that PLC link can be made normally to the link units of corresponding link No..
3	Stop in process	PLC link stop request relay will be ON and PLC link stops.

PLC link status stored in case of abnormal condition

Error code	Message	Cause/Remedy
100 (transfer source)	E100: communication time out	Normal PLC link is unavailable to the link units of transfer source or destination. Reasons are as follows. • Link units can't normally respond due to power OFF or other reasons. • Wiring to link units is abnormal due to broken communication cable or other reasons. • Settings of link units (IP address, port No. used in MC protocol, exchange code, etc.) are different.
101 (transfer destination)	E101: communication time out	
110 (transfer source)	E110: Link units not supported	Link units of transfer source or transfer destination include KV-1000/700. Please change it to KV-5500/5000/3000.
111 (transfer destination)	E111: Link units not supported	
200 (transfer source)	E200: out of device range	In simple PLC link setting for transfer source or transfer destination, the set device does not exist in, or is out of the range of the link unit of link destination.
201 (transfer destination)	E201: out of device range	
211	E211: Disable write under RUN	The link unit of transfer destination is set to Mitsubishi Q/ QnU, or Mitsubishi A, but the "write under RUN" of the link unit is not set to "Enable".
220 (transfer source)	E220: Link unit error	The link unit of transfer source or transfer destination returns an abnormal response.
221 (transfer destination)	E221: Link unit error	
300 (transfer source)	E300: Abnormal simple PLC link setting	The IP address of transfer source or transfer destination duplicates with the IP address of KV-EP21V (local station).
301 (transfer destination)	E301: Abnormal simple PLC link setting	

Unit-specific Commands for Simple PLC Link

The following describes the unit-specific commands for simple PLC link used in ladder program. When used in scripts, see "Unit-specific Functions of Simple PLC Link", page 13-28.

■ Unit-specific command

Function	Command	Description	Page
Read simple PLC link status	U_ELSTAT	To read the status of simple PLC link of all link No.s from buffer memory.	13-24
Read simple PLC link period	U_ELCYC	To read the simple PLC link period of all link No.s from buffer memory.	13-26

U_ELSTAT

U_ELSTAT (.U)



Read simple PLC link status

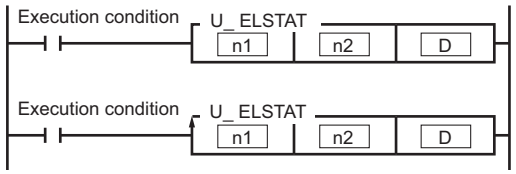
To read the status of simple PLC link from buffer memory.

@U_ ELSTAT

@ U_ELSTAT (.U)



Ladder program



Input method

U _ E L S T A T ␣ n1 ␣ n2 ␣ D ↵

@ U _ E L S T A T ␣ n1 ␣ n2 ␣ D ↵

Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	○	–	–	–	–
n2	○	–	○	–	–	–	○	○	○*2	○	○	○	○	○	○	○	–	○	○	○
D	○	–	○	–	–	–	○	○	○*2	○	○	–	–	–	○	–	–	○	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
n2	To specify link No. (0 to 31), or device which stores link No..*1
D	To specify the device to store the read status of simple PLC link. *1

*1 If bit device is specified by n2, D, consecutive 16 bits will be processed. If any relay (R002, R106, R1012 etc) other than leading relay of the channel is specified, 16 bits will be processed by crossing over to the next channel.

*2 EM, FM and ZF cannot be used with the KV Nano Series.

Operation Description

U_ELSTAT When the execution condition is ON, read the status of simple PLC link No. n2 from the n1 unit and store it in D.

	Buffer memory address		Device No.
PLC link status	#1522+ n2	⇒	D

@U_ ELSTAT At the rising edge of execution condition, scanning is executed once only.

Operation flag

CR2009	Not change
CR2010	Not change
CR2011	Not change
CR2012	It will be ON if any of the following conditions is satisfied, otherwise, it will be OFF. • The unit No. specified by n1 is out of range. • The unit with the unit No. specified with n1 is not KV-5500, KV-EP21V, KV-5000, KV-LE21V, KV-LE20V or KV-NC1EP. • In case the link No. specified by n2 is larger than 31 • The range of indirect specifying, or index modification is inappropriate

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

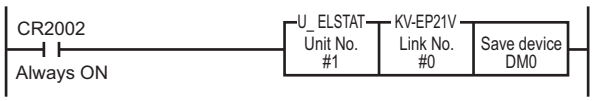
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 Series PLC User's Manual"

"KV Nano Series User's Manual"

Sample Program

Always read the status of PLC link No. 0 from the buffer memory and store it in DM0.

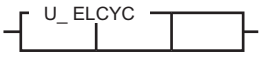


(Mnemonic list)

```
LD CR2002
U_ELSTAT #1 #0 DM0
```

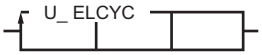
U_ELCYC

U_ELCYC (.U)



@U_ ELCYC

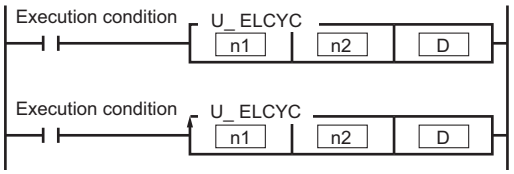
@ U_ELCYC (.U)



Read simple PLC link period

To read the PLC link period from the buffer memory.

Ladder program



Input method

U _ E L C Y C ␣ n1 ␣ n2 ␣ D ↵

@ U _ E L C Y C ␣ n1 ␣ n2 ␣ D ↵

Operand	Available device																			Index modification
	Bit device							Word device								Constant	Indirect specifying		Local device	
	R	DR	MR LR B	T	C	CTC	CR	DM TM W	EM FM ZF	T	C	CTH	CTC	Z	CM	#/$	#TM	*	@	:#/:Z
n1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	○	–	–	–	–
n2	○	–	○	–	–	–	○	○	○*2	○	○	○	○	○	○	○	–	○	○	○
D	○	–	○	–	–	–	○	○	○*2	○	○	–	–	–	○	–	–	○	○	○

Operand	Description
n1	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)). $ cannot be used.
n2	To specify link No. (0 to 31), or device which stores link No.. *1
D	To specify the device to store the read simple PLC link period. *1

*1 If bit device is specified by n2, D, consecutive 16 bits will be processed. If any relay (R002, R106, R1012 etc) other than leading relay of the channel is specified, 16 bits will be processed by crossing over to the next channel.

*2 EM, FM and ZF cannot be used with the KV Nano Series.

Operation Description

U_ELCYC When the execution condition is ON, read the period of simple PLC link No. n2 from the n1 unit and store it in D.

	Buffer memory address		Device No.
PLC link period	#1490+ n2	⇒	D

@U_ ELCYC At the rising edge of execution condition, scanning is executed once only.

Operation flag

CR2009	Not change
CR2010	Not change
CR2011	Not change
CR2012	It will be ON if any of the following conditions is satisfied, otherwise, it will be OFF. • The unit No. specified by n1 is out of range. • The unit with the unit No. specified with n1 is not KV-5500, KV-EP21V, KV-5000, KV-LE21V, KV-LE20V or KV-NC1EP. • In case the link No. specified by n2 is larger than 31 • The range of indirect specifying, or index modification is inappropriate

* If CR2012 is ON, command is not executed.

KV-5500/5000/3000 If the CR2012 is ON, the error details are stored in CM5150 to CM5176.

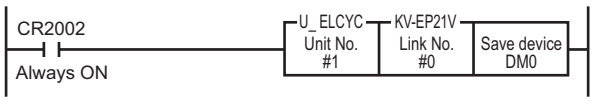
KV Nano series If the CR2012 is ON, the error details are stored in CM2250 to CM2276.

"KV-5500/5000/3000 Series PLC User's Manual"

"KV Nano Series User's Manual"

Sample Program

Always read the period of PLC link No. 0 from the buffer memory and store it in DM0.



(Mnemonic list)

```
LD CR2002
U_ELCYC #1 #0 DM0
```

Unit-specific Functions of Simple PLC Link

The following describes the unit-specific functions of simple PLC link used in script program. When used in ladder program, see " Unit-specific Commands for Simple PLC Link", page 13-23.

■ Unit-specific function list

Function	Command	Description	Page
Read simple PLC link status	U_ELSTAT	To read the status of simple PLC link of all link No.s from buffer memory.	13-29
Read simple PLC link period	U_ELCYC	To read the simple PLC link period of all link No.s from buffer memory.	13-30

U_ELSTAT Read simple PLC link status

U_ELSTAT ([execution condition]*1, unit No., link No., save destination device No.)

Argument/return value		Description	Operation type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n1	Unit No. *2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	○
n2	Link No.*4	To specify link No. (0 to 31), or device which stores link No..	.U	.U	.U	.U	-	-	-	-	○	○	○
D	Save destination device No. *3*4	To specify the device No. for storing the read PLC link status.	.U	.U	.U	.U	-	-	-	-	-	○	-
R	Return value	None	-	-	-	-	-	-	-	-	-	-	-

*1 Content in "[ ]" can be omitted. (if execution condition is omitted, the command is always executed (every scanning))

*2 "$" cannot be used (specify hex number).

*3 CTC, CTH, and Z cannot be specified.

*4 If bit device is specified by n2, D, consecutive 16 bits will be processed. If any relay (R002, R106, R1012 etc) other than leading relay of the channel is specified, 16 bits will be processed by crossing over to the next channel.

Operation Description

U_ELSTAT When the execution condition is ON, read the status of simple PLC link No. n2 from the n1 unit and store it in D.

● Format example

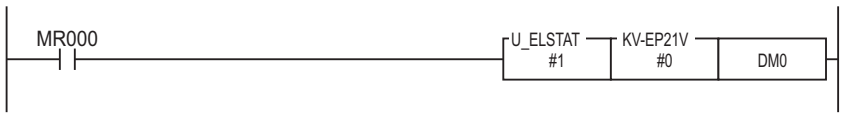
Script Programming

```
U_ELSTAT(MR0,1,0,DM0)
```

Operation description

When MR000 is ON, store the status of PLC link No. 0 of the first connected unit in DM0.

Ladder conversion



U_ELCYC Read simple PLC link period

U_ELSTAT([execution condition]*1, unit No., link No., save destination device No.)

Argument/return value		Description	Operation type								Constant	Device	Expression
			.U	.S	.D	.L	.F	.DF	.B	.T	#/$		
n1	Unit No. *2	Specify unit No. (0 to 63, "0" when specifying the KV-5500 as the main unit (1 to 8 for KV-NC1EP)).	-	-	-	-	-	-	-	-	○	-	○
n2	Link No. *4	To specify link No. (0 to 31), or device which stores link No..	.U	.U	.U	.U	-	-	-	-	○	○	○
D	Save destination device No. *3*4	To specify the device No. for storing the read PLC link period.	.U	.U	.U	.U	-	-	-	-	-	○	-
R	Return value	None	-	-	-	-	-	-	-	-	-	-	-

*1 Content in "[ ]" can be omitted. (if execution condition is omitted, the command is always executed (every scanning))

*2 "$" cannot be used (specify hex number).

*3 CTC, CTH, and Z cannot be specified.

*4 If bit device is specified by n2, D, consecutive 16 bits will be processed. If any relay (R002, R106, R1012 etc) other than leading relay of the channel is specified, 16 bits will be processed by crossing over to the next channel.

Operation description

U_ELCYC When the execution condition is ON, read the period of simple PLC link No. n2 from the n1 unit and store it in D.

- **Format example**

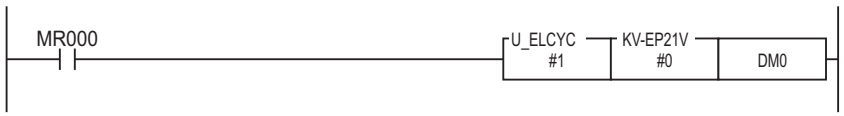
Script Programming

```
U_ELCYC(MR0,1,0,DM0)
```

Operation description

When MR000 is ON, store the period of PLC link No. 0 of the first connected unit in DM0.

Ladder conversion



14

ACCESS WINDOW

This chapter describes how to operate the EtherNet/IP Unit access window.

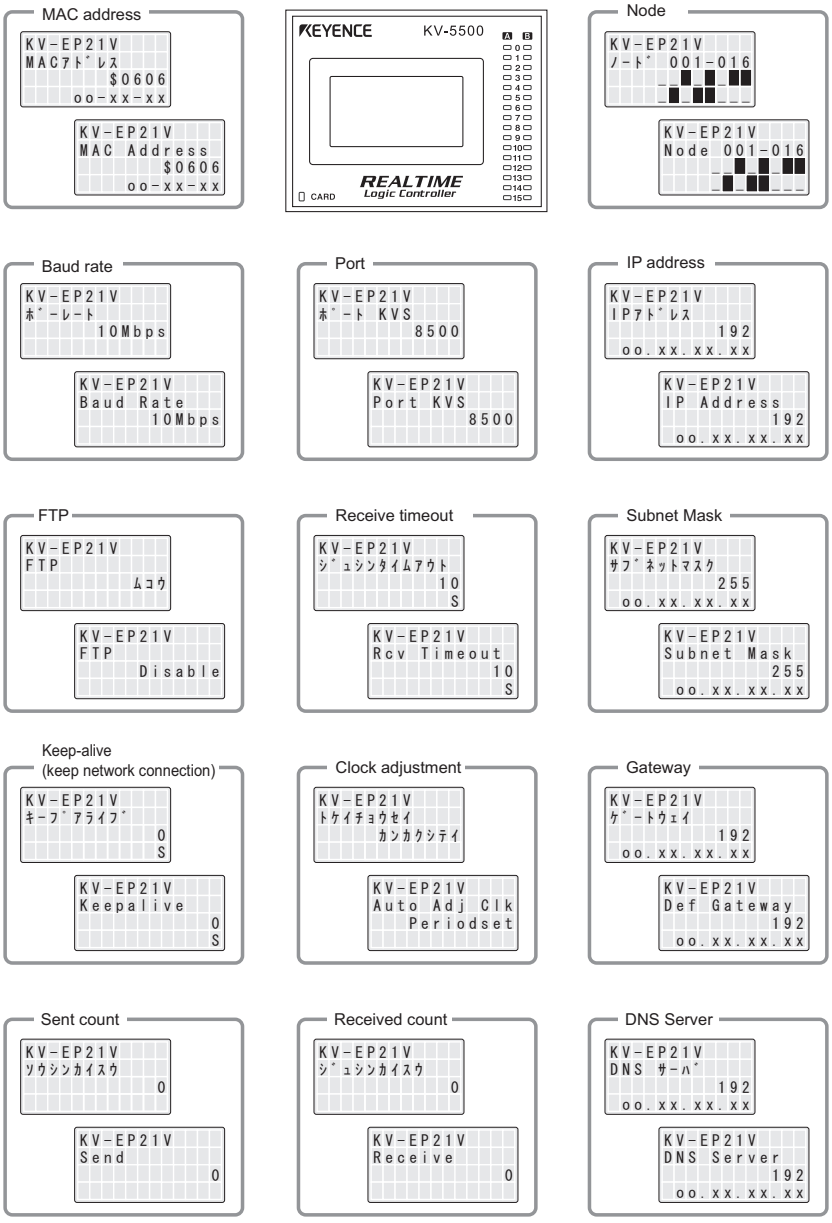
14-1 Access Window 14-2
14-2 Setting Screen 14-7
14-3 Monitor Screen 14-12

14-1 Access Window

This section describes the access window of CPU.

What is Access Window

The CPU unit access window can be used to monitor the EtherNet/IP Unit, and change its setting. The following items can be monitored and set in the access window.



Point

The extension access window cassette (KV-N1AW) cannot be used to monitor or change settings when using KV-NC1EP.

Settings in Access Window

The CPU unit access window can be used to monitor EtherNet/IP Unit information set in the Unit Editor conveniently.
Although some settings can be changed in the access window, it is recommended to use Unit Editor to make changes in general conditions.

Reference To change settings via access window, CPU unit should be in PROG mode. When switching CPU unit to RUN mode, actual setting change is valid. After the content is updated, before operation begins, it requires about 3s at the most.

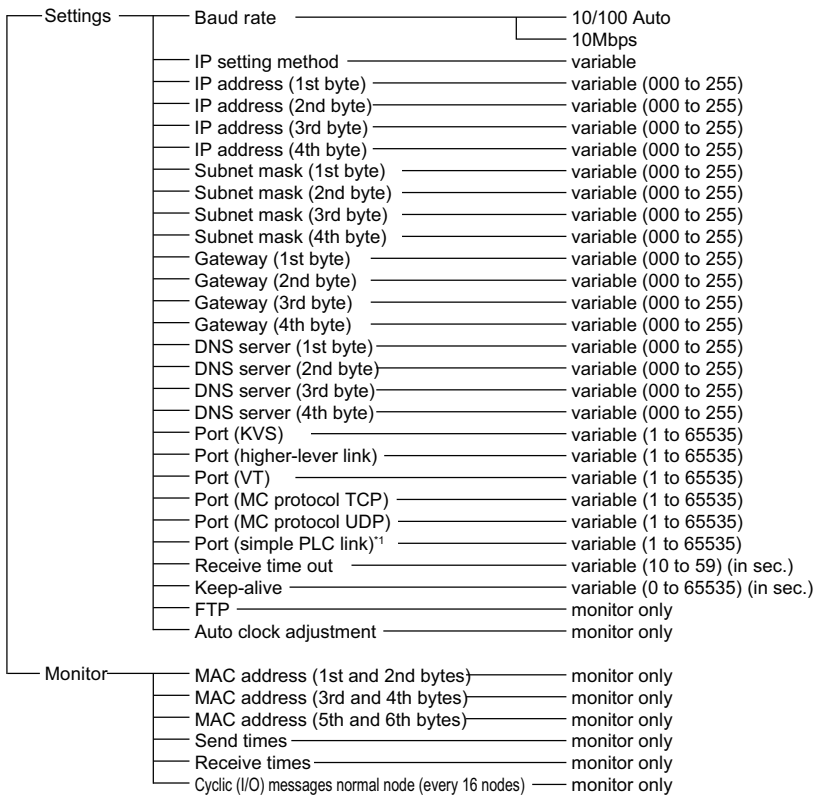
Point

- **If unit information is changed, existing connection will be cut off completely. Connection should be established again.**
- **Settings and the monitoring function cannot be used in the KV Nano Series extension access window cassette KV-N1AW.**

Menu Structure

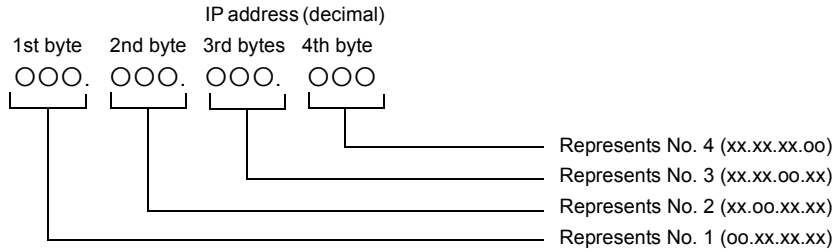
Menu structure of access window is as follows.
Items in "Settings" can be changed with Unit Editor.

"3-1 Unit Editor Setting", page 3-2

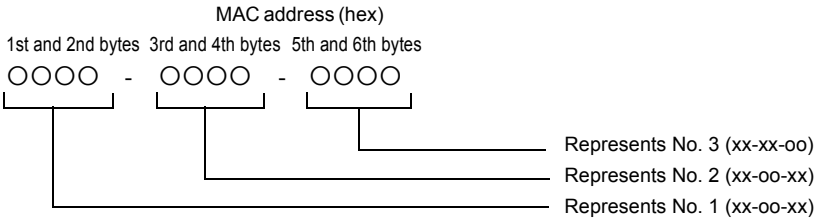


Reference

- In the access window, the EtherNet/IP Unit IP address, subnet mask, gateway, and DNS server can be divided into four parts using period, and displayed from left in turn.



- In the access window, the EtherNet/IP Unit MAC address is divided into three parts as per 2 bytes, displayed from left in turn.



Operating the Access Window

The setting operation key on CPU unit can be used to operate the access window.

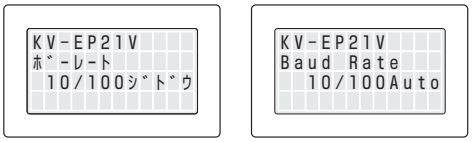
Setting operation key	General	In case of value change
M	Display menu	Display menu
↔	Unused.	Change variation digit.
▲	Switch page. When the setting is changed, options will also be changed.	Add variation to the set value.
▼	Switch page. When the setting is changed, options will also be changed.	Subtract variation from the set value.
↺	Press and hold for more than 1s, switch to the setting change status.	Press and hold for more than 1s, execute the setting change.

Moving to Menu Screen

■ When KV-EP21V is used

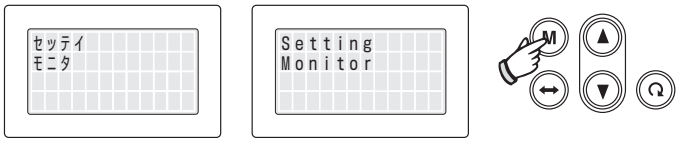
1 **Press the direct access switch of KV-EP21V to be set.**

Direct access switch illuminates, and the setting screen of selected KV-EP21V is displayed.



2 **Press "Ⓜ" key of CPU unit.**

Menu screen is displayed.



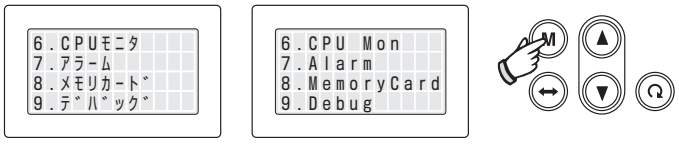
Point

To return to the menu screen of CPU unit, please press "Ⓜ" key again, or press the blinking direct access switch.

■ When KV-5500 is used

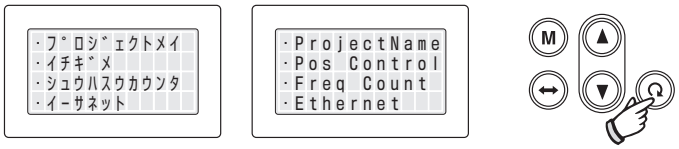
1 **Press "Ⓜ" key.**

Display menu. (if other unit is selected, please press "Ⓜ" key twice.)



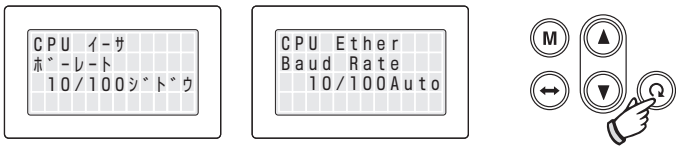
2 **Select "6. CPU monitor", and press "↺" key.**

Display CPU monitor menu.



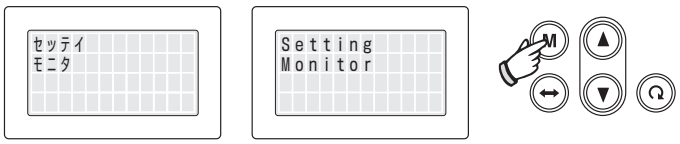
3 **Select "Ethernet", and press " ↺ " key.**

Display setting screen.



4 **Press " M " key of CPU unit.**

Display menu screen.



For details on access window, see 📖 KV-5500/5000/3000 User's Manual.

14-2 Setting Screen

This section describes how to change settings in the access window.

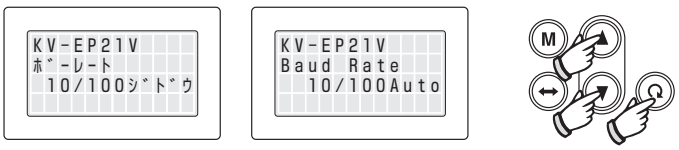
Baud Rate (Communication Rate)

Ethernet baud rate (communication rate) can be switched.

"3-1 Unit Editor Setting", page 3-2

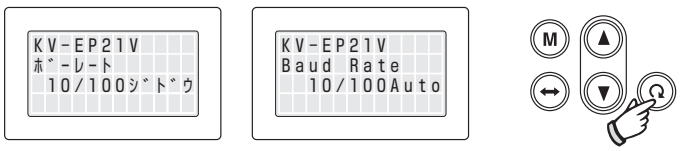
1 Use "▲" or "▼" key to select "Setting" from the menu screen, and press" ↺ " key.

Display baud rate screen.

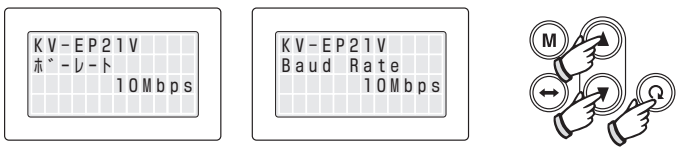


2 Press " ↺ " key and hold for more than 1s.

The setting item blinks.



3 Use "▲" or "▼" key to select baud rate (communication rate) to be set, and press " ↺ " key for more than 1s to confirm it.



Available baud rate (communication rate) is shown below:

10/100 automatic, 10Mbps

Point

Setting can be changed only when CPU unit is in PROGRAM mode. Setting cannot be changed in RUN mode.

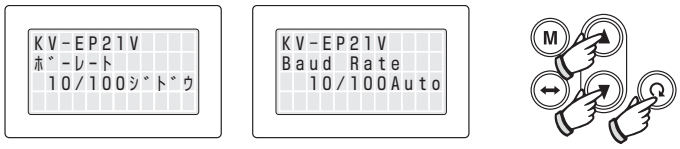
IP Address

The EtherNet/IP Unit IP address can be changed.

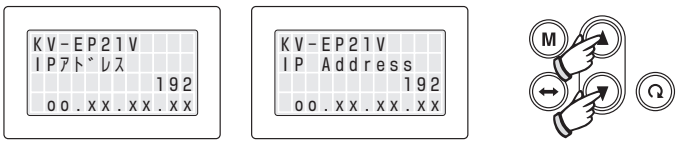
"3-1 Unit Editor Setting", page 3-2

1 Use "▲" or "▼" key to select "Setting" from the menu screen, and press "↺" key.

Display baud rate screen.

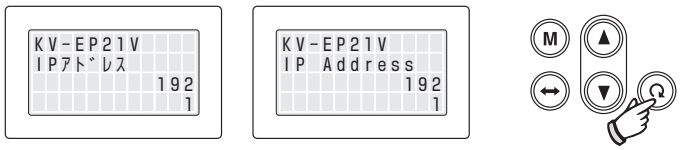


2 Select IP address (the 1st Byte) screen with "▲" or "▼" key.



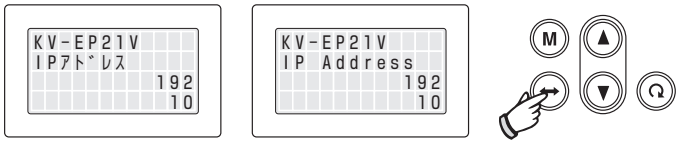
3 Press "↺" key and hold for more than 1s.

The setting item blinks, and increment/decrement value is displayed on lower right of the screen.

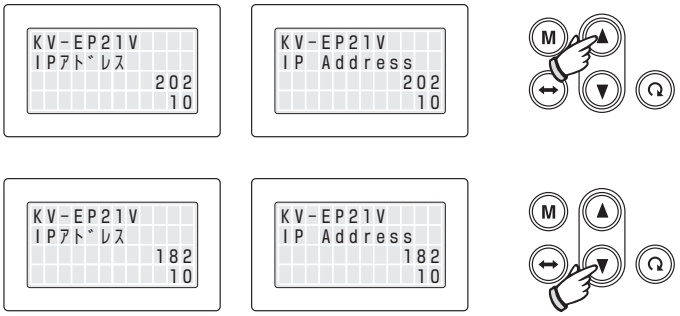


4 Set increment/decrement value.

Increment/decrement digit increases whenever "↔" key is pressed. If this value exceeds 10000, it returns to "1".



5 When pressing "▲" key, increment/decrement value increases; when pressing "▼" key, increment/decrement value decreases.



The setting value range is 0 to 255. In case the sum of set increment/decrement values exceeds 255, even if "▲" key is pressed, it is set to 255, which can not be larger than this value. In case after the set increment/decrement value is subtracted, it is less than 0, even if "▼" key is pressed, it is set to 0, which can not be smaller than this value.

6 After determined, press and hold "↺" key for more than 1s.

IP address (the 1st byte) is thus set.

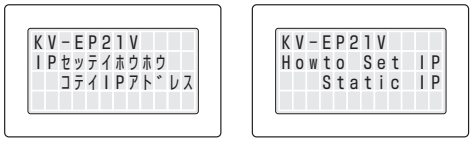
7 For IP address (the 2nd byte), IP address (the 3rd byte), and IP address (the 4th byte), please repeat the operation of 2 to 6.

Point

Setting can be changed only when CPU unit is in PROGRAM mode. Setting cannot be changed in RUN mode.

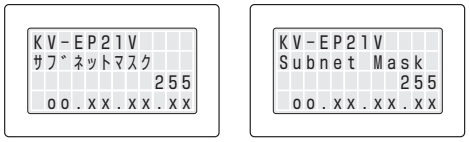
Other Setting Items

■ IP address setting method



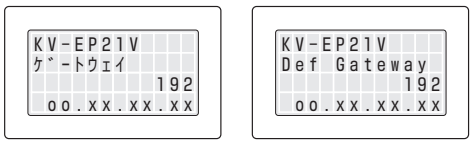
IP address setting method can be changed.
It is displayed when "Expansion function" is set to "Enable".

■ Subnet mask



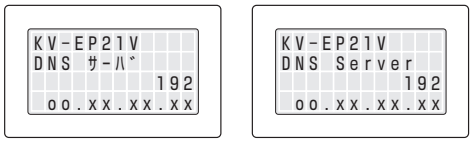
The setting of subnet mask can be changed.

■ Gateway



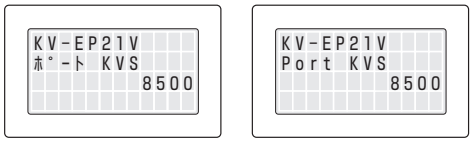
The setting of gateway can be changed.

■ DNS server



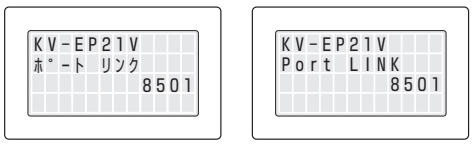
The setting of DNS server can be changed.

■ Port (KVS)



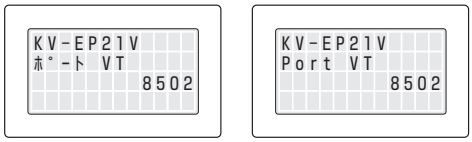
Port No. for communication with KV STUDIO, KV COM+ and DATA BUILDER can be changed.
Range: 1 to 65535 (1024 to 65535 recommended)

■ Port (host-link)



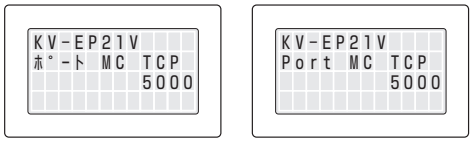
Port No. for the communication using host-link communication function can be changed.
Range: 1 to 65535 (1024 to 65535 recommended)

■ Port (VT)



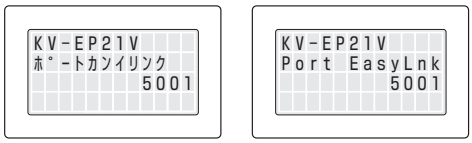
Port No. for communication with VT series touch panel display can be changed.
Range: 1 to 65535 (1024 to 65535 recommended)

■ Port (MC protocol TCP, MC protocol UDP)



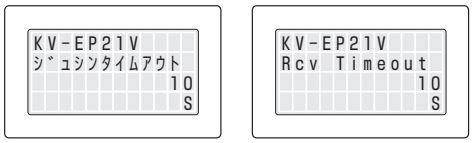
Port No. for the communication using MC protocol communication function can be changed.
Range: 1 to 65535 (1024 to 65535 recommended)

■ Port (simple PLC link)



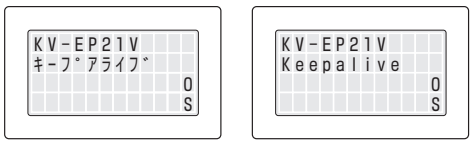
Port No. for communication using simple PLC link function can be changed.
Range: 1 to 65535 (1024 to 65535 recommended)

■ Receive time out



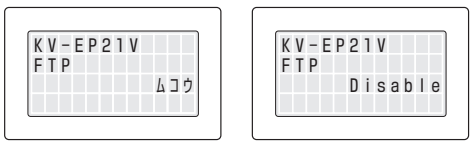
Receive time out value can be changed.
Range: 10 to 59 (s)

■ Keep-alive



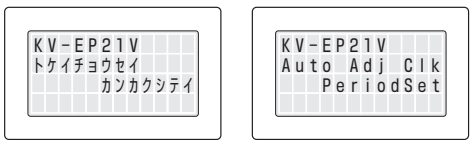
Keep-alive time can be changed.
Range: 0 to 65535 (s)

■ FTP



Check FTP setting status. The settings cannot be changed from access window, only setting status can be monitored.

■ Auto clock adjustment



Check the setting status of auto clock adjustment function. The settings cannot be changed from access window, only setting status can be monitored.

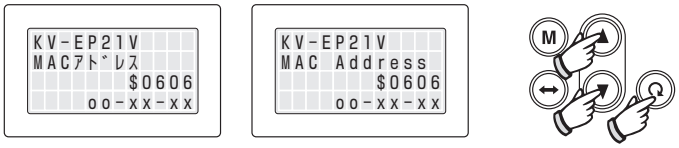
14-3 Monitor Screen

This section describes the monitor method using access window.

Monitor Method

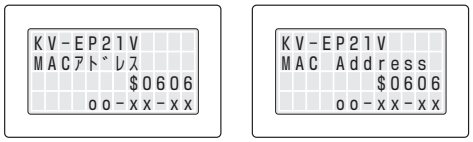
1 Use "▲" or "▼" key to select "Monitor" from the menu screen, and press "↺" key.

Display MAC address (the 1st and 2nd bytes) screen.



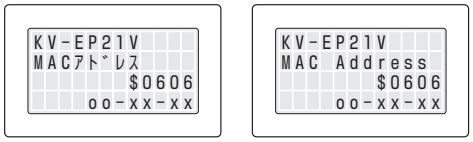
2 Use "▲" or "▼" key to select the display data to be monitored.

■ MAC address (the 1st and 2nd bytes)



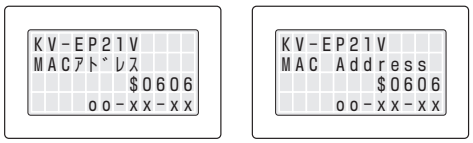
Display MAC address of the 1st and 2nd bytes of KV-EP21V.

■ MAC address (the 3rd and 4th bytes)



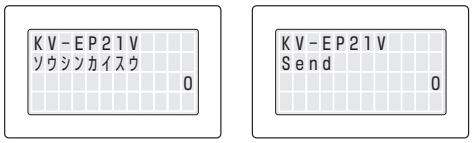
Display MAC address of the 3rd and 4th bytes of KV-EP21V.

■ MAC address (the 5th and 6th bytes)



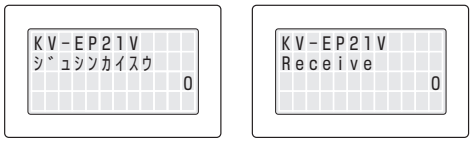
Display MAC address of the 5th and 6th bytes of KV-EP21V.

■ Send times



Number of data packets sent by KV-EP21V. It will be reset when power ON.

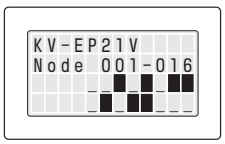
■ Receive times



Number of data packets received by KV-EP21V. It will be reset when power ON.

■ Cyclic (I/O) messages normal node





Display the node in normal cyclic (I/O) messages with the EtherNet/IP Unit.
When node is 001 to 016,
upper right end is node 1, upper left end is node 8,
lower right end is node 9, lower left end is node 16.

MEMO

15

MONITOR

This chapter describes monitor function and use methods with KV STUDIO.

15-1 Unit Monitor 15-2
15-2 Workspace Monitor 15-11

15-1 Unit Monitor

Unit Monitor function of Ladder Support Software KV STUDIO allows a best display of value of relays or DMs, buffer memories based on monitored unit. This section describes how to view and operate Unit Monitor.

Unit Monitor Overview

Unit monitor is the window for displaying values of relays or DMs, buffer memories.

Unit Monitor has the following functions:

- DMs, buffer memories and relays assigned to units can be displayed based on their initial register status.
- Display format and layout template are provided for each unit, facilitating monitoring.
- Independent of assignment of relays or DMs, buffer memories, only need to select unit to be monitored.

Point

Unit Monitor can only be selected from the monitor/online edit menu.

Display of Unit Monitor

Display monitor unit as per the following steps.

1 Select "Monitor/Simulator" ▶ "Unit Monitor" from the menu.

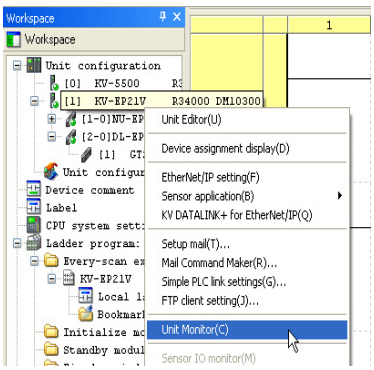
Display "Select Unit Monitor" dialog box.



2 Select the unit to be monitored, and click "Display" button.

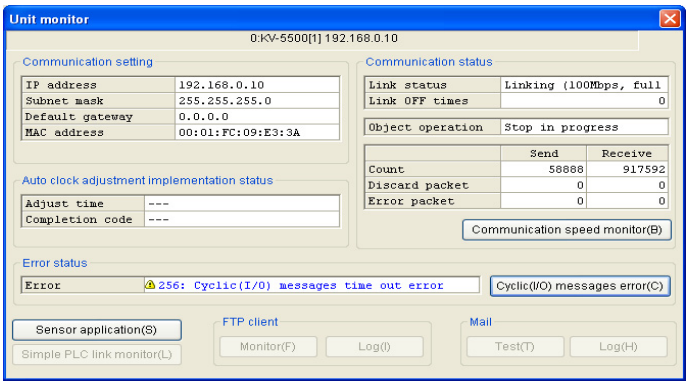
Otherprocedure

- In "Unit Setting" of the workspace, select the unit to be monitored, and select "Unit Monitor" from the right-click menu.
- In the Unit Editor, select the unit to be monitored, and select "Unit Monitor" from the right-click menu.
- On the Unit Editor, select the unit to be monitored, and select "Display" ▶ "Unit Monitor" from the menu.



15 MONITOR

■ EtherNet/IP Unit Monitor (the information below applies to KV-EP21V)



<Communication setting>

Item	Description	See page
IP address	Display the IP address of selected KV-EP21V. Execute the setup operation via Unit Editor.	3-7
Subnet mask*	Display subnet mask of subnet where the selected KV-EP21V is located. Execute the setup operation via Unit Editor.	3-7
Default gateway*	If gateway is used to build network, display IP address of the PC (or network unit) as gateway. Execute the setup operation via Unit Editor.	3-7
MAC address	Display MAC address of the selected KV-EP21V.	-

* Not display if IP address setting method is "BOOTP".

<Auto clock adjustment implementation status>

Item	Description	See page
Adjust time	Display the time of previous auto clock adjustment.	A-41
Completion code	When executing auto clock adjustment, store the execution result.	A-41

(Communication status)

Item		Description
Link status		Display link status and communication rate. Link stop in progress/link in progress (100Mbps, full duplex)/link in progress (100Mbps, half duplex)/link in progress (10Mbps, full duplex)/link in progress (10Mbps, half duplex)
Link OFF times		Display times of link stop occurred.
Object operation		KV-EP21V displays operation status when data link between scanners is established; link is being opened from other scanners. Operation in progress: connection for data communication between scanners is more than 1, communication is normal. Stop in progress : failed to open connection from other scanners or connection is stopped after it had been opened. Time out in progress : communication error occurred between scanners after connection is opened.
Count	Send	Display the number of IP data packets KV-EP21V sent/received from other Ethernet units. It will be reset when power on.
	Receive	
Discard	Send	Display the number of data packets not needed by KV-EP21V among IP data packets sent and received by KV-EP21V. It will be reset when power on.
	Receive	
Error packet	Send	Display the number of error data packets among* IP data packets received and sent by KV-EP21V. It will be reset when power on.
	Receive	
"Communication speed monitor"		Pop up "Communication Rate Monitor" dialog box.

* The send times of error data packets is 0 under environment without abnormal communication path.

<Error status>

Item	Description
Error	Display error occurred to KV-EP21V.
"Cyclic (I/O) messages error"	Pop up "Cyclic (I/O) messages error" dialog box.

"Sensor application" button : Display "Backup sensor settings/batch transmission sensor settings" dialog box. The execution status, execution log and error log of each function can be checked.

"Simple PLC Link Monitor" button : Display "Simple PLC Link Monitor" dialog box. Link status and link period of simple PLC link communication can be checked.

"(FTP Client) Monitor" button : Display "FTP Client Monitor" dialog box. Execution status of FTP client can be checked.

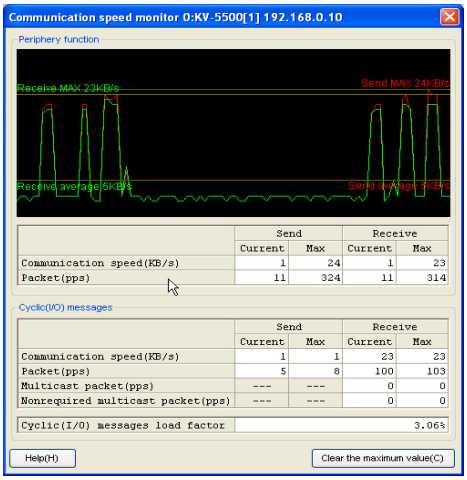
"(FTP Client) Log" button : Display "FTP Client Log" dialog box. Execution log of FTP client can be checked.

"(Mail) Test" button : Display "Mail Test" dialog box. PLC event-triggered mail send test is available.

"(Mail) Log" button : Display "Mail Log" dialog box. Mail send log, mail receive log and error log can be checked.

● Communication speed monitor

Click "Communication speed monitor" button to display "Communication speed monitor" dialog box. Communication rate of peripheral functions (other than cyclic (I/O) messages function) and communication rate of cyclic (I/O) messages can be monitored.



Item		Description
<Peripheral functions*> (functions other than cyclic (I/O) messages such as simple PLC link and explicit messages)		
	(Graph area)	Current value and maximum value of communication data received/sent per second when using peripheral functions is displayed in this area in the form of graph.
	Communication speed (KB/s)	Display respectively current value and maximum value of communication data quantity (KB) per second by send/receive.
	Packet quantity (pps)	Display respectively current value and maximum value of the number of communication data packets per second by send/receive.
<Cyclic (I/O) messages>		
	Communication speed (KB/s)	Display respectively current value and maximum value of communication data quantity (KB) per second by send/receive.
	Packet quantity (pps)	Display respectively current value and maximum value of the number of communication data packets per second by send/receive.
	Multicast packet quantity (pps)	Display the number of multicast packets received by KV-EP21V per second.
	Nonrequired multicast packet quantity	Display the number of multicast packets toward other scanners received by KV-EP21V per second (the number of unwanted multicast packets). * When establishing connection, even the multicast packet of KV-EP21V will also be temporarily counted as unwanted multicast packets.
	Cyclic (I/O) messages load factor	Display cyclic (I/O) messages load rate (%) which is obtained by dividing the number of communication data packets (pps) used by KV-EP21V cyclic (I/O) messages with allowable communication bandwidth of cyclic (I/O) messages.
"Clear the Maximum Value"		Clear all maximum value.

* Besides simple PLC link, explicit messages, sensor application, host-link, mail send/receive, FTP server and FTP client, communication with KV STUDIO, KV COM+, DATA BUILDER and touch panel are also included.

Point

Communication rate includes Ethernet header size and IP header size etc, but not includes preamble size, FCS size, etc.

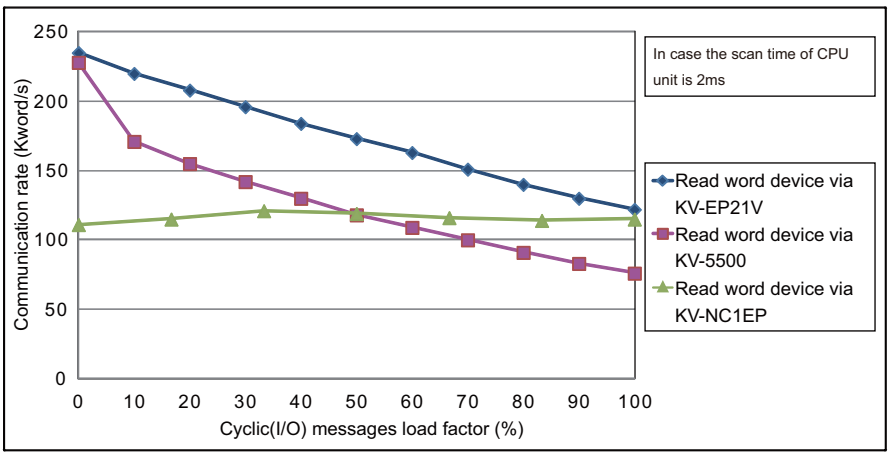
Reference

Usage of "Communication Speed Monitor"

KV-EP21V will handle cyclic (I/O) messages in top priority.
Therefore, if the communication speed of cyclic (I/O) messages is getting higher, the communication speed of concurrent peripheral functions (functions other than cyclic (I/O) messages) may not be ensured.
"Communication speed monitor" can be used for monitoring communication speed of peripheral functions, if sufficient communication rate can not be obtained, communication load should be adjusted.
Adjusting communication load of cyclic (I/O) messages while using "Communication speed monitor" can set to the optimal communication condition.

Please adjust communication load of cyclic (I/O) messages according to the following data.
If the communication load of cyclic (I/O) messages is getting lower, communication speed of peripheral functions can be improved.
The communication load of cyclic (I/O) messages can be adjusted by the number of connections used or RPI (communication period) of connections, data size.

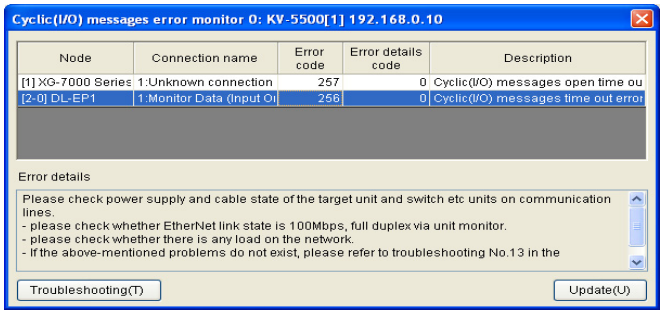
Cyclic (I/O) messages load factor and communication rate (device read rate) when the KV COM+ Library is used



* For the cyclic (I/O) messages load factor and link period, see "Cyclic (I/O) messages load factor and link period", page 4-61

● Cyclic (I/O) messages error

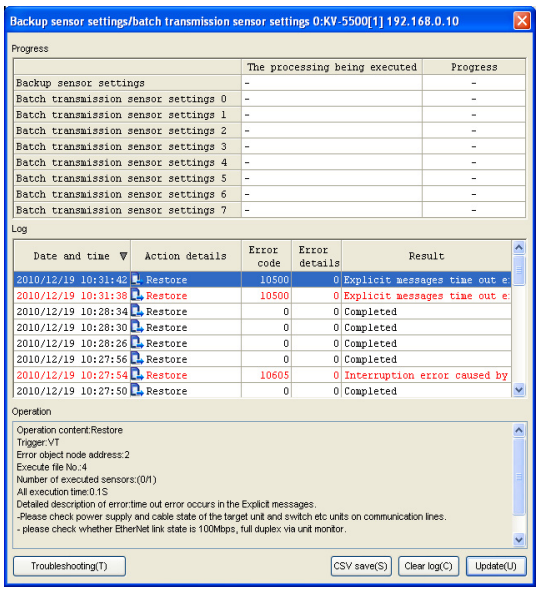
Click "Cyclic (I/O) messages error" button to display "Cyclic (I/O) messages error" monitor.
Cyclic (I/O) messages error details is displayed, please click "Troubleshooting" button to check the troubleshooting contents displayed.



"Troubleshooting" button : display the troubleshooting contents.
"Update" button : update the status of error occurred in cyclic (I/O) messages.

● Sensor application

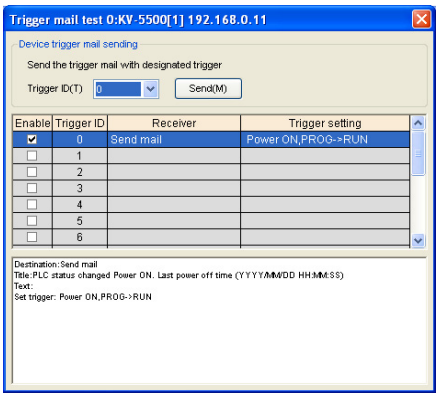
Click "Sensor application" button to display "Backup sensor settings/batch transmission sensor settings" dialog box.
You can view the execution status, execution log, and error log of backup sensor settings function and batch transmission sensor settings function. In case of error, please click "Troubleshooting" button to check troubleshooting contents displayed.



"Troubleshooting" button : display the troubleshooting contents.
"CSV Save file" button : save execution log of sensor application function to CSV file.
"Clear Log" button : clear execution log of sensor application function.
"Update" button : update execution log of sensor application function.

● "Mail" test

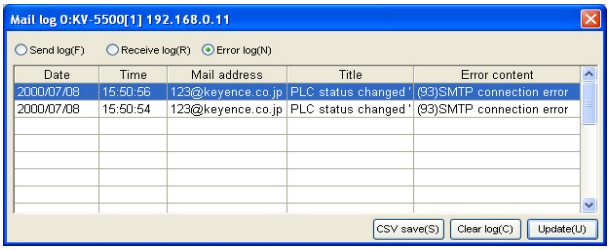
Click "Test" button to display "Mail Test" dialog box.
PLC event-triggered mail send test is available.



Select trigger ID, and click "Send" button.

● "Mail" log

Click "Log" button to display "Mail Log" dialog box.
You can view mail send log, receive log, and error log.

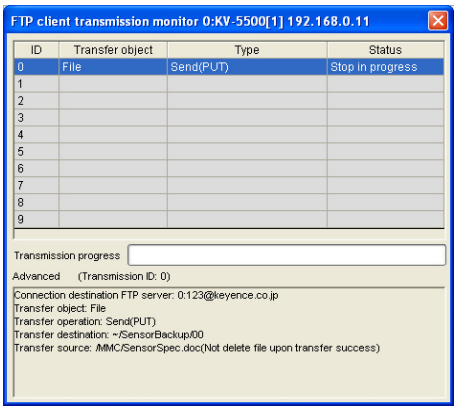


"Update" button : update mail log.
"Log Clear" button : clear mail log.
"Save CSV" button : save mail log as CSV file.

* For error details, see "Mail Send Complete Code List", page 10-22.

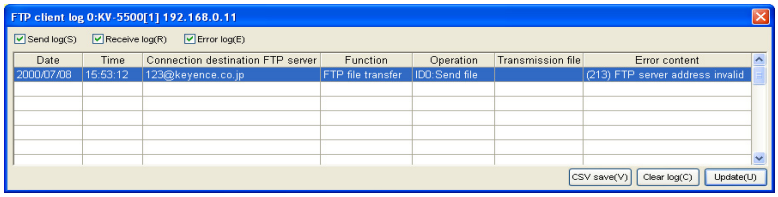
● <FTP client> monitor

Press "Monitor" button to display "FTP client monitor" dialog box.
You can view execution contents and transfer status of FTP client.



● <FTP client> log

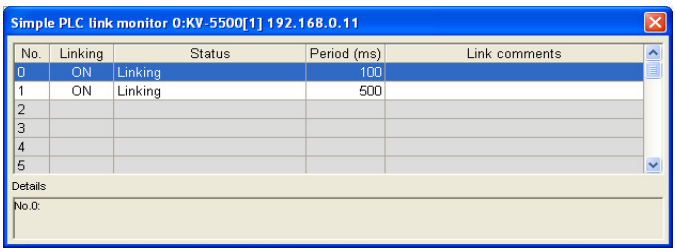
Press "Log" button to display "FTP client log" dialog box.
You can view execution log of FTP client.



"Update" button : update FTP client log.
"Clear Log" button : clear FTP client log.
"CSV Save" button : save FTP client log to CSV file.

● Simple PLC link monitor

Click "Simple PLC Link Monitor" button to display "Simple PLC Link Monitor" dialog box.
You can view link status and link period of simple PLC link communication.

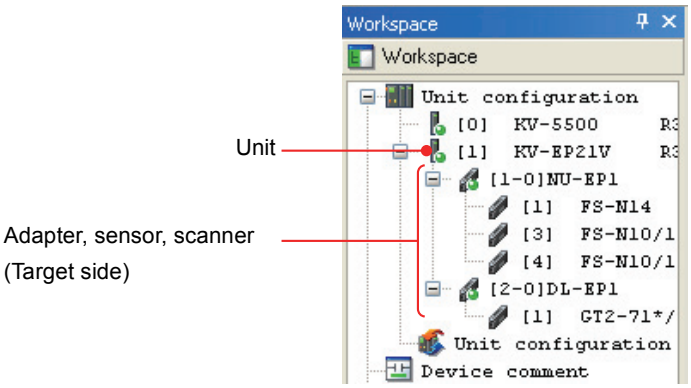


15-2 Workspace Monitor

You can monitor communication status between the EtherNet/IP Unit and EtherNet/IP Devices in the Ladder Support Software KV STUDIO workspace. Also you can open the monitor screen for the device used by cyclic (I/O) messages from the right-click menu. This section describes the view method and operating method for workspace when monitoring.

Display of Workspace Monitor

During monitor with Ladder Support Software KV STUDIO, you can monitor the operation status of EtherNet/IP Units, or the status of cyclic (I/O) messages with connected EtherNet/IP Devices in the workspace.



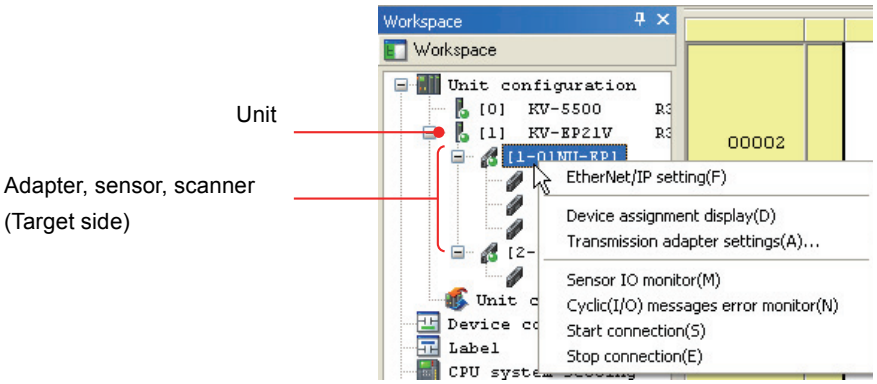
Item	Description
Unit	(Green) : Unit operation is normal. (Red) : Error occurred in unit.
Adapter, scanner	(Green) : Execute normally cyclic (I/O) messages with the EtherNet/IP Unit. (Red) : Error occurred during cyclic (I/O) messages with the EtherNet/IP Unit. : Cyclic (I/O) messages with the EtherNet/IP Unit is stopped. : Connection or communication retry is in progress.

Point

There is no change to display of sensor connected to communication adapter.

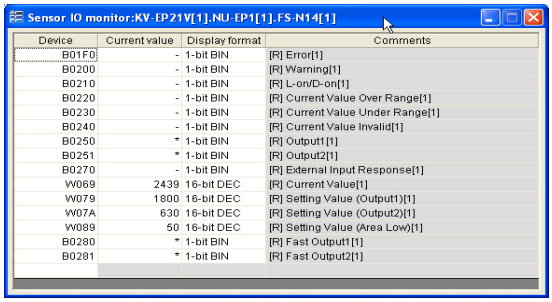
Right-click Menu of Workspace Monitor

When monitoring with Ladder Support Software KV STUDIO, after right clicking EtherNet/IP Units or EtherNet/IP Devices in the workspace, the following monitor menu used by cyclic (I/O) messages will appear.



Right-click menu	Description	
Sensor I/O monitor	Pop up "Sensor I/O Monitor" dialog box. Display device assigned to the selected unit.	
Cyclic (I/O) messages error monitor	Pop up "Cyclic (I/O) messages error" dialog box. It does not depend on the selected unit. "Cyclic (I/O) messages error", page 15-7	
Connection start/ connection stop	Unit	Start/stop cyclic (I/O) messages with all adapters, sensors and scanners.
	Adapter	Start/stop cyclic (I/O) messages with all selected adapters and connected sensors.
	Sensor	- (not display)
	Scanner	Start/stop cyclic (I/O) messages with all selected scanners.

● Sensor I/O monitor



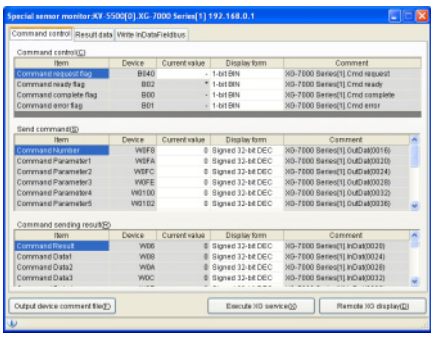
When selecting unit: you can monitor device assigned to tag setting of unit.

When selecting adapter: you can monitor device in data send/receive area to adapters.

When selecting sensor: you can monitor device in data send/receive area to sensors.

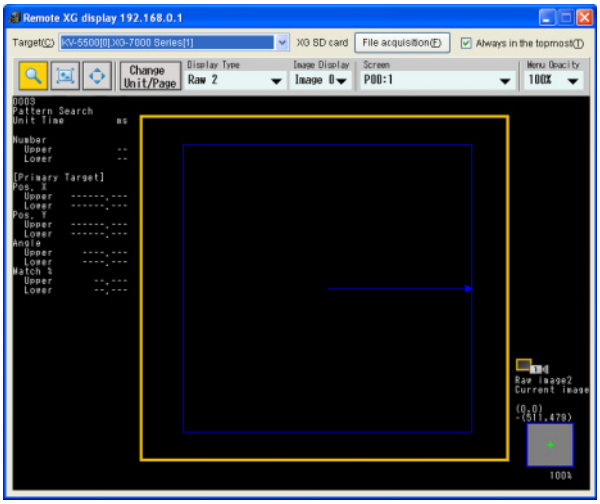
When selecting scanner: you can monitor devices in data send area from scanners.

● Special sensor monitor



To monitor devices when connecting to XG series.

- Remote XG display



To monitor pictures captured in XG series.

Point

Requirements when remote XG display used

CPU

Pentium 4 1.4GHz or higher

Pentium 4 2.4GHz or higher recommended

Memory

512 MB or higher (2GB or higher for pictures with 5 million pixels)

Communication settings

Ethernet

(PC and XG series to be monitored shall be connected in Ethernet if required.)

APPENDIX

This chapter describes dimensions, device list, error list and troubleshooting for the KV-5500 EtherNet/IP function, KV-EP21V and KV-NC1EP. It also describes auto clock data adjustment function.

1	Devices Used by EtherNet/IP Units	A-2
2	Communication without Unit Setting/BOOTP	A-5
3	Changing IP addresses	A-7
4	Error List	A-8
5	Troubleshooting	A-16
6	Auto Clock Data Adjustment Function	A-39
7	EtherNet/IP Route Connection Function	A-42
8	Dimension	A-43
9	ASCII Code Table	A-44
10	Index	A-45

1 Devices Used by EtherNet/IP Units

Number of Used Device

The number of devices used by the EtherNet/IP Unit is as follows.
The used devices are the same for KV-EP21V, KV-5500 and KV-NC1EP.

■ Number of used relays and DMs

Number of used relays: 640 points (40ch)
Number of used DMs: 230 words

Point

In cyclic (I/O) messages with EtherNet/IP Device, the device assigned to cyclic (I/O) messages data is excluded.

■ Buffer memory

Buffer memory is available in EtherNet/IP Units, and command can be used for access. For the assignment of buffer memory, see relevant pages of devices for various functions. However, buffer memory address behind #2810 has been reserved for the system, please do not use.

Common Devices Used in EtherNet/IP Units

Common relays, DMS, and buffer memories of EtherNet/IP Units are as follows.

■ Relay

n: Leading relay No.

Relay No.	Name	Function	R/W
n+714*	IP address settings change request	Changes from OFF to ON when IP address settings are changed. When it changes from OFF to ON, the IP address is changed to the value stored in #1570 to 1573 in the buffer memory.	R/W
n+1714*	IP address settings change reception complete	ON when the IP address settings change request turns ON. OFF when the IP settings change request relay is OFF. The timing that the current IP address value changes and settings are updated is as follows. • When mode is changed from PROG to RUN • When power is turned on • When Reset service execution is complete	R
n+1715*	IP address settings change reception failure	ON when the IP address settings change request has failed to be received. OFF when the IP settings change request relay is OFF.	R
n+1900	IP address active relay	ON when the IP address is set in the EtherNet/IP Unit. In case IP address setting method is set to "BOOTP", or "BOOTP-> fixed IP auto switching", the relay is OFF if address is not assigned.	R
n+1901	Ethernet link status relay	ON when Ethernet link is established.	R

* Can be used only when KV-NC1EP is being used.

■ DM, buffer memory

N: Leading DM No.

DM No.	Buffer memory address	Name	Function	R/W
N +0 to 1	#0 to 1	Number of sends L/H	Store EtherNet/IP Unit send times.	R
N +2 to 3	#2 to 3	Number of receives L/H	Store EtherNet/IP Unit receive times.	R
N +4	#4	Last clock change time (yymm)	Execution time of auto clock data adjustment (Y/M/D/H/M/S) is stored as 1 high/low bit hex number.	R
N +5	#5	Last clock change time (ddhh)		R
N +6	#6	Last clock change time (mmss)		R
N +7	#7	Clock adjustment comp code	When clock data are adjusted automatically, store the value.	R
N +8	#8	Sckt use state (KVS)	Store the number of sockets used in the communication with KV STUDIO, KV COM+, DATA BUILDER.	R
N +9	#9	Sckt use state (host link)	Store the number of sockets used in host-link communication.	R
N +10	#10	Reserved for system	Unavailable	-
N +11	#11	Sckt use state (FTP server)	Store number of sockets used for FTP.	R
N +12	#12	Reserved for system	Unavailable	-
N +13	#13	MAC address (the 1st and 2nd bytes)	Store the EtherNet/IP Unit MAC address.	R
N +14	#14	MAC address (the 3rd and 4th bytes)		R
N +15	#15	MAC address (the 5th, and 6th bytes)		R
–	#16	MC protocol socket usage condition	Store the number of sockets used for MC protocol communication.	R
N +20	-	Error code	Store error code, detailed error code, error node address, error slot No., error connection No., and error vendor ID of the setting error, and cyclic (I/O) messages error in EtherNet/IP Units.	R
N +21	-	Specific error code		R
N +22	-	Error node address*1		R
N +23	-	Error slot No. *1		R
N +24	-	Error connection No. *1		R
N +25	-	Error vendor ID*1		R
–	#1566	IP address [1/4]	Store the EtherNet/IP Unit IP address. Store 0 if IP address is not set.	R
–	#1567	IP address [2/4]		R
–	#1568	IP address [3/4]		R
–	#1569	IP address [4/4]		R

DM No.	Buffer memory address	Name	Function	R/W
-	#1570*2	IP address set value [1/4]	The set value is stored when the IP address settings are changed. Values are fetched when the IP address settings change request relay turns ON.	R/W
-	#1571*2	IP address set value [2/4]		R/W
-	#1572*2	IP address set value [3/4]		R/W
-	#1573*2	IP address set value [4/4]		R/W

*1 They are stored only in case of cyclic (I/O) messages error, and 0 is stored in case of setting error.

*2 Can be used only when KV-NC1EP is being used.

Device used for the EtherNet/IP Unit Functions

For devices used for EtherNet/IP Unit functions, see the following content.

- **Device used in cyclic (I/O) messages function**

"Devices used in cyclic (I/O) messages", page 4-63

- **Device used in explicit messages (client) function**

"Device used for Explicit Messages Communication", page 4-99

- **Device used in node status acquisition function**

"Device Used in Node Status Acquisition Function", page 4-157

- **Device used in sensor application function**

"Device used in backup sensor settings function", page 7-18
"Devices used in Batch Transmission Sensor Settings Function", page 7-55

- **Device used in mail send/receive function**

"The Device Used in the Mail Send/Receive Function", page 10-20

- **Device used in FTP client function**

"Device Used in FTP File Transfer", page 12-19
"Device Used for Logging/Tracing Transfer", page 12-36

- **Device used in simple PLC link function**

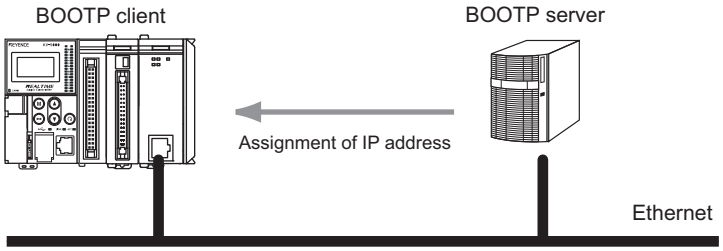
"Devices Used in Simple PLC Link Function", page 13-20

2 Communication without Unit Setting/BOOTP

The IP address setting method of EtherNet/IP Units can be selected as "BOOTP". If "BOOTP" is selected to execute Ethernet connection, IP address can be set in KV STUDIO or BOOTP server. In addition, if BOOTP is started before EtherNet/IP Unit setting, communication without unit setting with KV STUDIO is available.

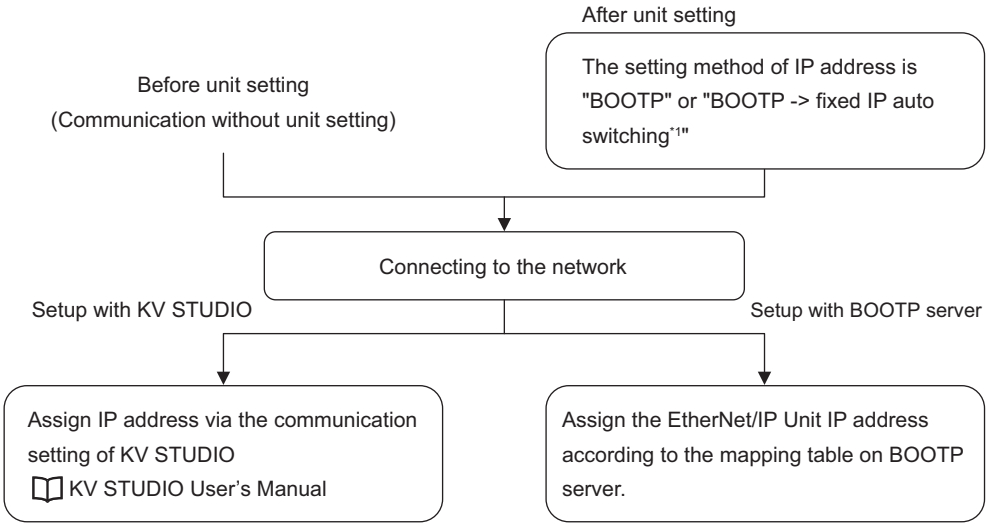
What is BOOTP

BOOTP is the abbreviation of BOOTstrap Protocol based on which, information of units such as IP address, can be set from BOOTP server automatically.
If BOOTP server and the unit serving as BOOTP client are in the same network, IP address corresponding to MAC address can be assigned to BOOTP client unit according to the preset MAC address and IP address mapping table.



IP Address Setting Procedure When BOOTP is Used

When connected to the network, EtherNet/IP Units before unit setting (factory setting etc), or EtherNet/IP Units with IP address setting method set to "BOOTP", or "BOOTP->fixed IP auto switching", will serve as BOOP client. When EtherNet/IP Units serve as BOOTP clients, IP addresses can be set from KV STUDIO or BOOTP server connected on the network.



*1 In case of "BOOTP -> fixed IP auto switching", if IP address is not assigned, it serves as BOOTP client; if IP address is assigned, it will be changed to fixed IP address setting automatically.

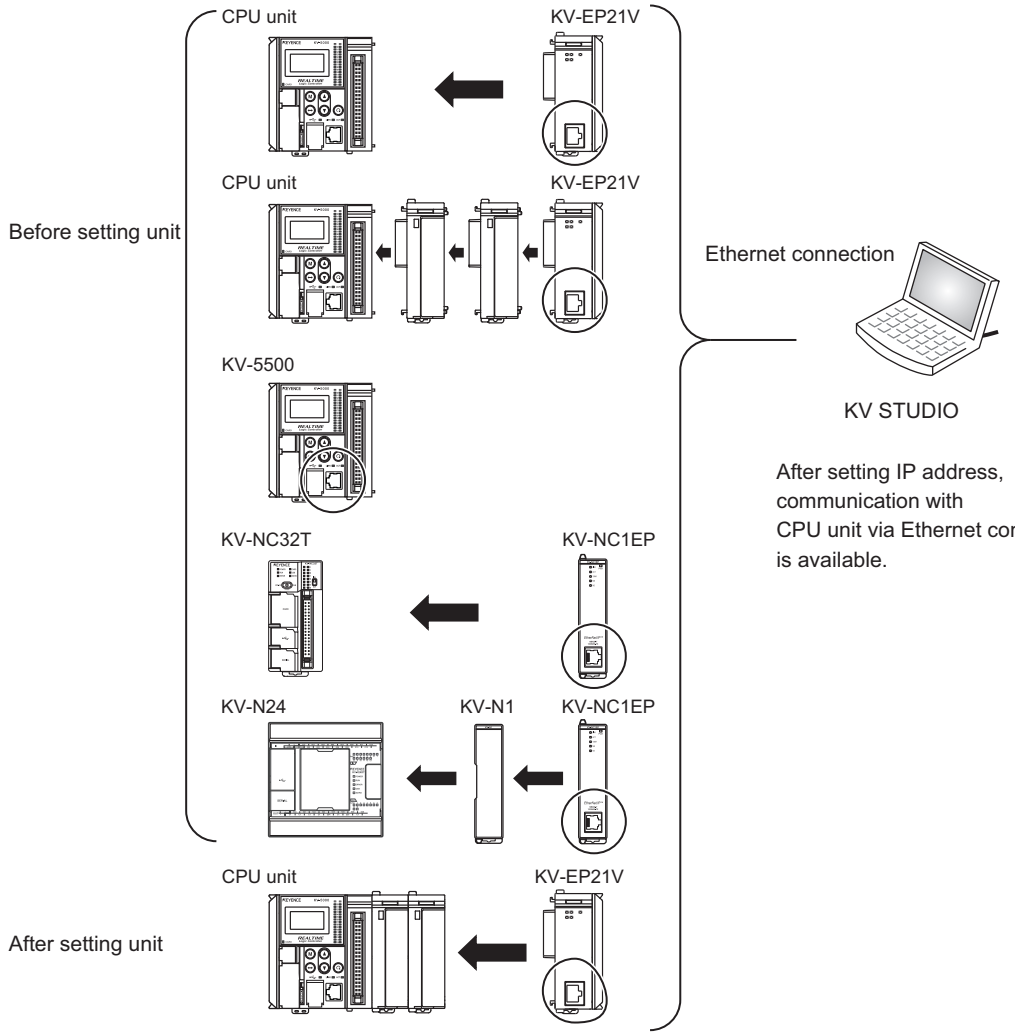
Reference P address assignment/unassignment can be checked from IP address active relay (n + 1900).

Communication without Unit Setting

When EtherNet/IP Units before unit setting are connected with CPU units, EtherNet/IP ports of KV STUDIO and the EtherNet/IP Unit can be used for communication with CPU units via the Ethernet connection. Before unit setting, the EtherNet/IP Unit starts with BOOTP, therefore, after the EtherNet/IP Unit IP address is set from KV STUDIO, the project can be transferred to the CPU unit.

Point

When any connection (USB connection etc) other than Ethernet connection is used, EtherNet/IP Unit setting is not required in advance.



Point

Before unit setting, the EtherNet/IP port of the EtherNet/IP Unit starts with BOOTP, so devices which do not have an assigned IP address can be searched for, and IP addresses can be set in KV STUDIO.

APPENDIX

3 Changing IP addresses

To change the IP address for each EtherNet/IP Unit, use the following procedure.

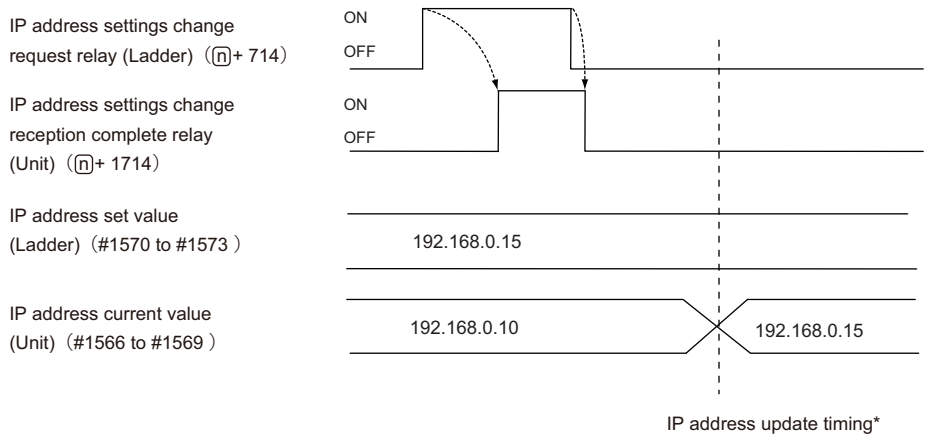
Changing method	KV-EP21V	KV-5500	KV-NC1EP	See page
Unit Editor	○	○	○	3-2
Access Window	○	○	×	14-2
KV STUDIO (EtherNet/IP Settings)	○	○	○	5-2
IP address settings change request relay	×	×	○	-

Reference In addition to the above, IP addresses can also be changed using applications with BOOTP server functions, such as the IP Setting Tool.

This section explains how to change the IP address using the IP address settings change request relay.

Point **The IP addresses for KV-EP21V and KV-5500 cannot be changed using the IP address settings change request relay.**

■ Procedure for changing IP addresses



* The IP address is updated at the following times:
  - When mode changes from PROG to RUN
  - When power is turned ON again.
  - When the Identity object Reset service is received in explicit messages (in PROG mode only)

(1) Turn the IP address settings change request relay ON.
(2) When the IP address settings change request is accepted, the IP address settings change reception complete relay turns ON.
(3) Confirm that the IP address settings change reception complete relay is ON, and turn OFF the IP address settings change request relay.
(4) The IP address changes at the IP address update timing.

Point
- **IP addresses cannot be changed during RUN mode.**
- **For the IP address to actually change, when the IP address settings change reception complete relay has turned ON, it is necessary to change from PROG to RUN and so on.**
- **When the IP address settings change request relay is ON, the IP address setting method changes to fixed IP address. (It stops being BOOTP)**
- **If the IP address is set as "0.0.0.0" or "127.0.0.1", the IP address setting change reception failure relay turns ON when the IP address settings change reception complete relay turns on.**

4 Error List

EtherNet/IP Unit errors include the following two types.

■ Setting error

Such error occurs when an error occurs on Ethernet setting.

- If error occurs, red MS lamp blinks, or red lamp illuminates, red lamp of direct access switch also illuminates. By pressing the switch, error code is displayed in the access window of CPU unit.
- If error occurs, corresponding error code is stored in [Error Code] (N + 20).
- If error cause is eliminated, green lamp of the direct access switch illuminates, and "0" is stored in [Error Code] (N + 20).
- For various measures related to setting error, see "Setting Error List", page A-9.

■ Cyclic (I/O) messages error

Such error occurs in cyclic (I/O) messages. If cyclic (I/O) messages error is regarded as unit error, operation is as follows.

"Cyclic (I/O) messages error", page 4-17

- If error occurs, red MS lamp blinks, red lamp of direct access switch also illuminates. By pressing the switch, error code is displayed in the access window of CPU unit.
- If error occurs, error details is stored in the following devices.

Device type	Device No.	Name
DM	N +20	Error code
	N +21	Specific error code
	N +22	Error node address
	N +23	Error slot No.
	N +24	Error connection No.
	N +25	Error vendor ID

- If error cause is eliminated, "0" is stored in each DM.
- For various measures related to cyclic (I/O) messages error, see "Cyclic (I/O) Messages Error List", page A-10.

Reference

- Even if cyclic (I/O) messages error is not regarded as unit error, cyclic (I/O) messages error can be checked from cyclic (I/O) messages error node of the buffer memory or cyclic (I/O) messages error monitor of .KV STUDIO
- The EtherNet/IP Unit error log will be stored in the CPU unit. Therefore, for "Operation Setting in Case of Error" in "CPU system setting" of KV STUDIO, if "Unit Error" is not set to "Store Error Log", or for battery-less working, error log will not be stored.

Setting Error List

Reference When problems could not be solved according to the content of cause/measures, see the description of troubleshooting No.. "Troubleshooting", page A-16

Error code (decimal)	Detailed error code (decimal)	Error message	Cause and measures	Troubleshooting No.
10001	0	IP address setting error	Exception exists in IP address setting. • Check the setting of IP address.	23
10002	0	Default gateway setting error	Exception exists in the default gateway setting. • Check setting of default gateway.	24
10003	0	Route setting error	Exception exists in route setting. • Check route setting.	25
10004	0	Port No. setting error	Exception exists in port No. setting. • Check port No. setting.	26
10005	0	EEPROM read error *	Hardware fault may occur. Please consult the nearest office of KEYENCE.	27
10008	0	IP address duplicate error	Other terminals (nodes) on the network have duplicate IP address. • Check IP address setting, and IP address setting of the terminals (nodes) on the same network.	28
10009	0	Duplicate system port error	Port No. setting is duplicate with the port reserved for system. • Set port No. to other than 67, 8503, port No. (system extension), 8505, port No. (system extension 2).	29
10020	0	Cyclic (I/O) messages load overflow error	Overload, so failed to start cyclic (I/O) messages. • Select communication start node within the load range.	30
10021	0	DNS setting error	Exception exists in DNS server setting. • Check the IP address setting of DNS server.	31
10022	0	Adapter IP address setting error	The EtherNet/IP Unit IP address is the same as the adapter unit IP address setting. • Check the IP address setting of adapter unit.	32
10023	0	EtherNet/IP setting error	The connected EtherNet/IP Unit does not support the set data. • Check whether any function that could not be used by the connected EtherNet/IP Unit is set.	37

* If EEPROM read error occurs, red MS lamp illuminates.

Cyclic (I/O) Messages Error List

Reference When problems could not be solved according to the content of cause/measures, see the description of troubleshooting No.. "Troubleshooting", page A-16

■ Cyclic (I/O) messages error list

Error code (decimal)	Detailed error code (decimal)	Error message	Cause and measures	Troubleshooting No.
0	0	-	Normal	-
1	256	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit.	1
1	259	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit. • Check send trigger setting in the connection setting of EtherNet/IP setting.	33
1	262	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit.	5
1	263	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit.	1
1	264	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit. • Check connection type setting via the connection setting of EtherNet/IP setting.	34
1	265	Cyclic (I/O) messages error size error	• Check whether the set unit is consistent with the connected unit. • Check whether correct data size is set via connection setting of EtherNet/IP setting.	6
1	272	Cyclic (I/O) messages target not set error	• Check whether the set unit is consistent with the connected unit.	7
1	273	Cyclic (I/O) messages unsupported RPI error	• Check whether the set unit is consistent with the connected unit. • Check whether RPI is within the specification range of target unit in the connection setting of EtherNet/IP setting.	8
1	275	Cyclic (I/O) messages number of connections error	• Check whether the set unit is consistent with the connected unit. • Check whether the number of opened connections exceeds the number supported by the target unit.	9
1	276	Cyclic (I/O) messages compatibility check error	Vendor ID or product code (EDS) is inconsistent with the target unit. • Check whether the connected unit is compatible with the set unit.	4
1	277	Cyclic (I/O) messages compatibility check error	Device type (EDS) is inconsistent with the target unit. • Check whether the connected unit is compatible with the set unit.	4

Error code (decimal)	Detailed error code (decimal)	Error message	Cause and measures	Troubleshooting No.
1	278	Cyclic (I/O) messages compatibility check error	Revision (EDS) is inconsistent with the target unit. • Check whether the connected unit is compatible with the set unit.	4
1	279	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit. • When tag is used for communication, check whether the setting of specified tag in the connection setting of EtherNet/IP setting is consistent with the tag setting defined in the target unit.	2
1	280	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit.	1
1	281	Cyclic (I/O) messages Listen Only error	• Check whether the set unit is consistent with the connected unit.	10
1	282	Cyclic (I/O) messages number of connections error	• Check whether the set unit is consistent with the connected unit. • Check whether the number of opened connections exceeds the number supported by the target unit.	11
1	283	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit. • Check whether the set RPI exceeds production inhibit time in the connection setting of EtherNet/IP setting.	12
1	515	Cyclic (I/O) messages error	• Check power supply and cable status of target unit and Ethernet switch etc on the communication lines. • Check Ethernet link status to be 100Mbps, full duplex link via unit monitor. • Check whether load exists on the network.	13
1	516	Cyclic (I/O) messages error	• Check power supply and cable status of target unit and Ethernet switch etc on the communication lines. • Check whether EtherNet/IP setting is consistent with IP address of the target unit. • Check whether IP address of the target unit is set. • Check whether there is any unit in the network that has the same IP address as the target unit.	14
1	517 to 519	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit.	1
1	769	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit.	1
1	770	Cyclic (I/O) messages bandwidth guarantee failure error	• Check whether the set unit is consistent with the connected unit. • Check whether it is used out of the allowable communication bandwidth (data packet/sec) supported by the target unit.	15

Error code (decimal)	Detailed error code (decimal)	Error message	Cause and measures	Troubleshooting No.
1	771 to 774	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit.	1
1	785	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit.	1
1	786	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit. • Check the configuration of rack configuration unit.	35
1	789	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit. • When tag is used for communication, check whether the setting of specified tag in the connection setting of EtherNet/IP setting is consistent with the tag setting defined in the target unit. • When instance ID is used for communication, please check whether the instance ID No. Specified in connection setting is consistent with instance ID No. of the target unit.	2
1	790 to 793	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit.	1
1	794, 795	Cyclic (I/O) messages rack error	• Check whether the set unit is consistent with the connected unit.	16
1	796 to 799	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit.	1
1	800 to 2047	(vendor intrinsic error)	Vendor intrinsic error. See the target unit manual. *	1
1	2048	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit.	1
1	2064	Cyclic (I/O) messages target data error	• Check whether the set unit is consistent with the connected unit. • Check whether target unit is in ready status to send data.	36
1	2065 to 2068	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit.	1
2	0	Cyclic (I/O) messages resource unusable error	• Check whether the set unit is consistent with the connected unit. • Target unit has used maximum number of connections. • Reduce the number of active connections of target unit.	11
8	0	Cyclic (I/O) messages error	The connected unit does not support cyclic (I/O) messages. • Check whether the set unit is consistent with the connected unit.	1
9	0	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit.	1
12	0	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit.	1

* When KEYENCE EtherNet/IP Device is used, see "Detailed error code when KEYENCE unit is used (vendor intrinsic error)", page A-14.

Error code (decimal)	Detailed error code (decimal)	Error message	Cause and measures	Troubleshooting No.
16	0	Cyclic (I/O) messages device status error	• Check whether the set unit is consistent with the connected unit. • Check whether target unit is in error status.	1
19	0	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit.	1
21	0	Cyclic (I/O) messages error	• Check whether the set unit is consistent with the connected unit.	1
208 to 255	0	Cyclic (I/O) messages adapter unit intrinsic error	Adapter unit intrinsic error. For details, please consult adapter unit producer.	1
256	0	Cyclic (I/O) messages time out error	• Check power supply and cable status of target unit and Ethernet switch etc on the communication lines. • Check Ethernet link status to be 100Mbps, full duplex link via unit monitor. • Check whether load exists on the network.	13
257	0	Cyclic (I/O) messages establishment time out error	• Check power supply and cable status of target unit and Ethernet switch etc on the communication lines. • Check whether EtherNet/IP setting is consistent with IP address of the target unit. • Check whether IP address of the target unit is set. • Check whether there is any unit in the network that has the same IP address as the target unit.	14

■ Detailed error code when KEYENCE unit is used (vendor intrinsic error)

(error code: 1)

Detailed error code (decimal)	Error message	Causes and measures	Troubleshooting No.
801	Cyclic (I/O) messages beyond max. number of sensors error	Number of sensors connected on the target unit is out of range, or sensor is added in the operation process. • Check whether the target unit is connected correctly with the sensor. • Check whether the set unit is consistent with the connected unit.	3
802	Cyclic (I/O) messages inter-sensor communication error	Inter-sensor communication error occurs in the target unit. • Check whether the connection of the target unit and sensor is correct. • Check whether the set unit is consistent with the connected unit.	17
803	Cyclic (I/O) messages sensor authentication error	Unsupported sensor is connected with the target unit, or inter-sensor communication error occurs in the target unit. • If unsupported sensor is connected, please remove the sensor. • Check whether the set unit is consistent with the connected unit.	18
804	Cyclic (I/O) messages different types of sensor exist error	The sensor connected on the target unit is not the specified combination. • Check target unit manual. • Check whether the set unit is consistent with the connected unit.	19
805	Cyclic (I/O) messages unsupported sensor error	Unsupported sensor is connected on the target unit. • Remove the unsupported sensor. • Check whether the set unit is consistent with the connected unit.	18
806	Cyclic (I/O) messages beyond max. number of sensors error	Beyond the number of sensors connected on the target unit. • Reduce the number of connected sensors. • Check whether the set unit is consistent with the connected unit.	3
807	Cyclic (I/O) messages sensor restart in progress error	Number of sensors connected on the target unit reduces in the operation process, or target unit is restarting. • If cyclic (I/O) messages is not recovered automatically, check whether target unit is connected correctly with the sensor. • Check whether the set unit is consistent with the connected unit.	20
808	Cyclic (I/O) messages sensor restart in progress error	Number of sensors connected on the target unit is reduced in the operation process. • Check whether the target unit is connected correctly with the sensor. • Check whether the set unit is consistent with the connected unit.	17

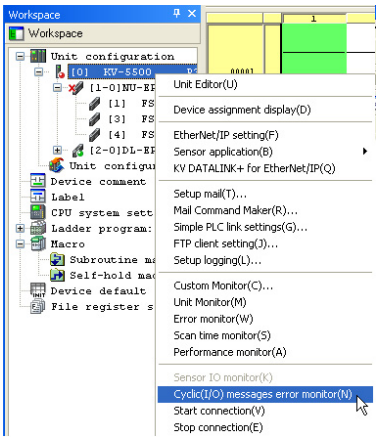
Detailed error code (decimal)	Error message	Causes and measures	Troubleshooting No.
1216	Cyclic (I/O) messages compatibility check error	Series code (EDS) is inconsistent with the target unit. • Check whether the connected unit is compatible with the set unit.	21
1217	Cyclic (I/O) messages compatibility check error	Series version (EDS) is inconsistent with the target unit. • Check whether the connected unit is compatible with the set unit.	21
1600	Cyclic (I/O) messages compatibility check error	Rack unit configuration setting exception. Unit configured to error slot is not connected. • Check whether the connected unit is compatible with the set unit.	21
1664	Cyclic (I/O) messages compatibility check error	Rack unit configuration setting exception. Unit on the error slot is assigned to slot area of other slot unit. • Check whether the connected unit is compatible with the set unit.	21
1728	Cyclic (I/O) messages compatibility check error	Rack unit configuration setting exception. Number of slots used (EDS) by the unit on the error slot is inconsistent with the target unit. • Check whether the connected unit is compatible with the set unit.	21
1792	Cyclic (I/O) messages compatibility check error	Rack unit configuration setting exception. Product code (EDS) of the unit on the error slot is inconsistent with the target unit. • Check whether the connected unit is compatible with the set unit.	21
1856	Cyclic (I/O) messages compatibility check error	Rack unit configuration setting exception. Revision (EDS) of the unit on the error slot is inconsistent with actual situation. • Check whether the connected unit is compatible with the set unit.	21
1920	Cyclic (I/O) messages compatibility check error	Rack unit configuration setting exception. Series code (EDS) of the unit on the error slot is inconsistent with the target unit. • Check whether the connected unit is compatible with the set unit.	21
1984	Cyclic (I/O) messages compatibility check error	Rack unit configuration setting exception. Series version (EDS) of the unit on the error slot is inconsistent with the target unit. • Check whether the connected unit is compatible with the set unit.	21

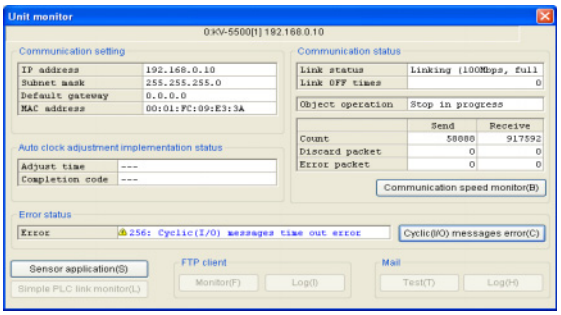
5 Troubleshooting

This section describes the troubleshooting method for EtherNet/IP Unit errors.
Check troubleshooting No. according to the following steps, and refer to troubleshooting method of corresponding No.

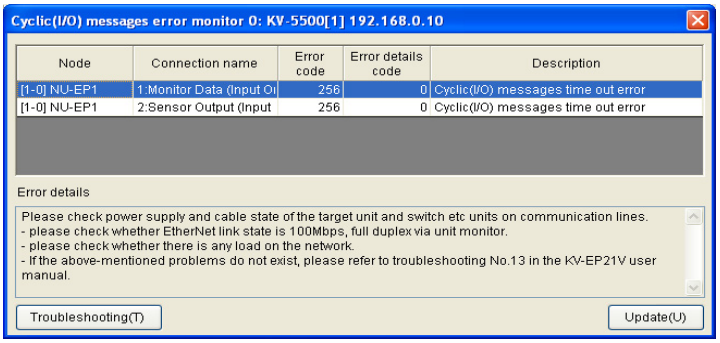
■ How to check troubleshooting No. (cyclic (I/O) messages function)

1 In KV STUDIO workspace, select KV-EP21V from the unit configuration, then select "Cyclic (I/O) messages error monitor" from the right-click menu, or click the "Cyclic (I/O) messages error" button on the KV-EP21V Unit Monitor.





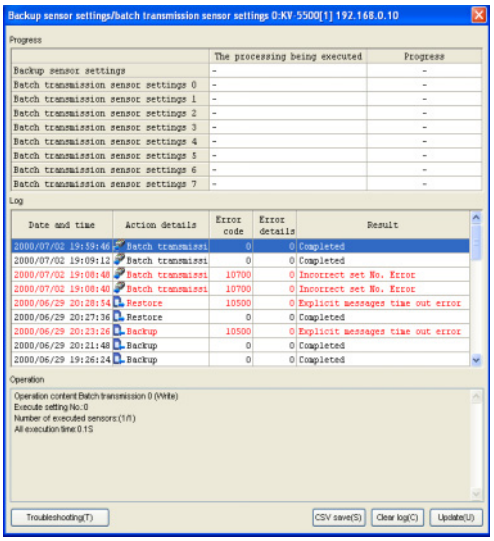
2 Check the troubleshooting No. recorded in error details of "Cyclic (I/O) messages error monitor".



■ How to check troubleshooting No. (Sensor application)

- For backup sensor settings, and batch transmission sensor settings

  (1) Check the operation log displayed through "Unit Monitor" > "Sensor Application" of KV STUDIO.



  (2) Check complete code of sensor application function (batch backup complete code N+102, batch restore complete code N+108, individual backup complete code N+116, individual restore complete code N+122, batch transmission read and write complete code), check corresponding troubleshooting No. in "List of the Complete Codes of the Sensor Application Functions", page 7-96.

- For sensor setting command

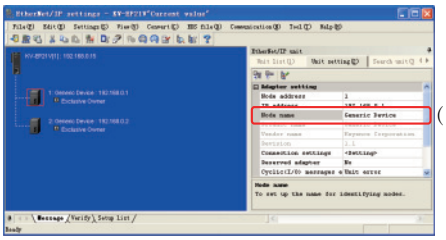
  Check current value of "Complete code" in command result storage device (the 5th operand), check corresponding troubleshooting No. in "List of the Complete Codes of the Sensor Application Functions", page 7-96.

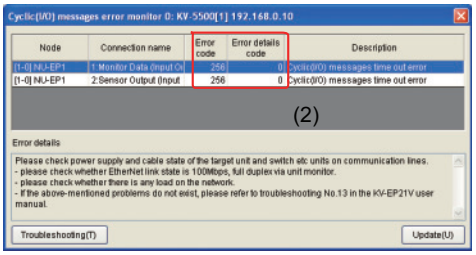
■ Necessary information for consultation

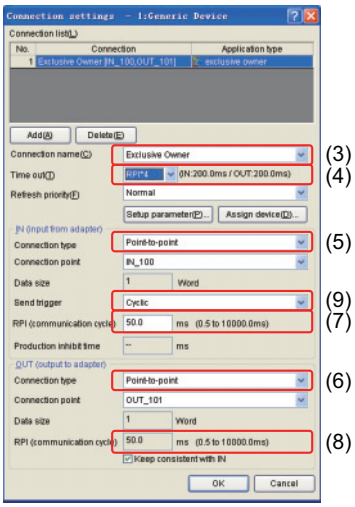
To consult the target unit producer, please firstly confirm the following content.

Necessary information for consultation (1) (cyclic (I/O) messages function)

To consult the target unit producer, please firstly confirm the following content.







- (1) Product name
- (2) CIP error occurred

  It is displayed in decimal in KV STUDIO tools. CIP error is generally represented by hex number, so when consulting the target unit producer, please convert to hex number then consult.
- Connection setting information
  - (3) Connection name
  - (4) Time out
  - Connection type: (5)IN (input from the adapter)
    (6) OUT (output to the adapter)
  - RPI (communication period):(7) IN (input from the adapter)
    (8) OUT (output to the adapter)
  - (9) Send trigger

Necessary information for consultation (2) (Sensor application)

To consult the target unit producer, please firstly confirm the following content.

(1)Content of the error parameter (parameter No.)

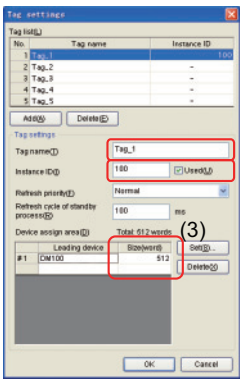
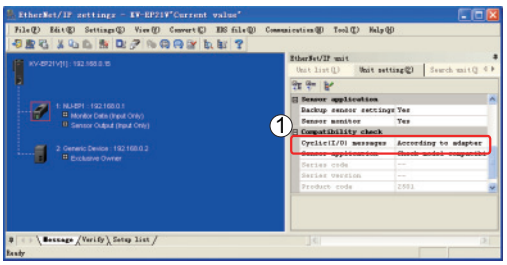
For the check method, see troubleshooting.

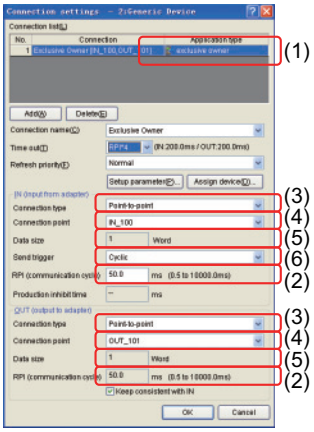
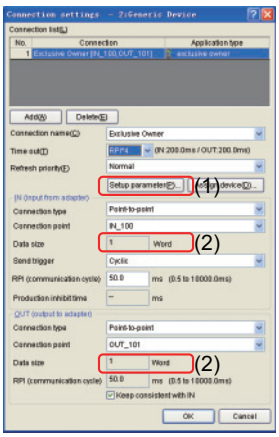
For details on parameter No., see "Available parameter for sensor parameter read/write command", page 7-72 in the manual.

(2) Content of service executed by the error parameter

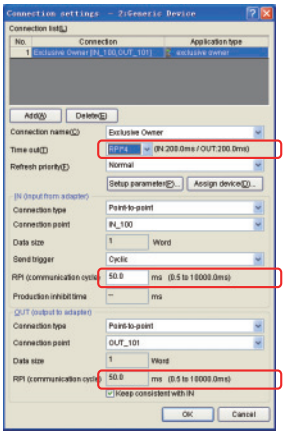
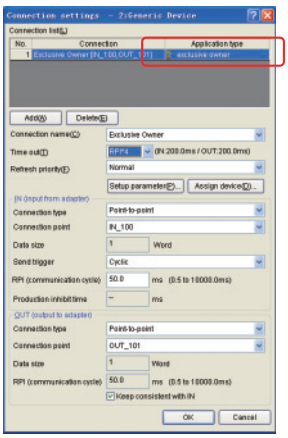
Get_Attribute_Single service is used to read parameters, Set_Attribute_Service is used to write parameters.

■ Troubleshooting (cyclic (I/O) messages function)

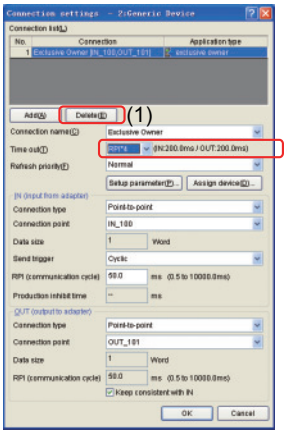
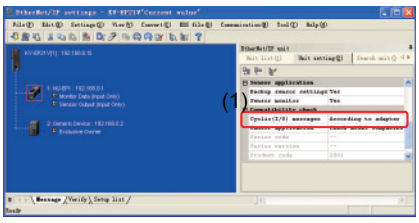
No.	Measures
1	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • If there is no problem in the setting, please consult the target unit producer. To consult the target unit producer, please check "Necessary information for consultation (1)" in advance.
2	• Check if the connected unit is compatible with unit set in EtherNet/IP setting. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • When tag is used for communication, please check whether tag name ((1) in right figure) and size ((3) in right figure) of the tag setting are the same as tag content in the target unit setting. • When instance ID is used for communication, please check whether instance ID ((2) in right figure) in the tag setting is the same as instance ID No. in the target unit setting. • If there is no problem in the setting, please consult the target unit producer. To consult the target unit producer, please check "Necessary information for consultation (1)" in advance. 
3	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether the connection of the target unit and sensor is correct. • Reduce the number of connected sensors.
4	• Check if the connected unit is compatible with unit set in EtherNet/IP setting. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether compatibility check of EtherNet/IP setting, and cyclic (I/O) messages setting ((1) in right figure) are correct. For details on compatibility check, see "Compatibility check", page 4-18.  • If there is no problem in the setting, please consult the target unit producer. To consult the target unit producer, please check "Necessary information for consultation (1)" in advance.

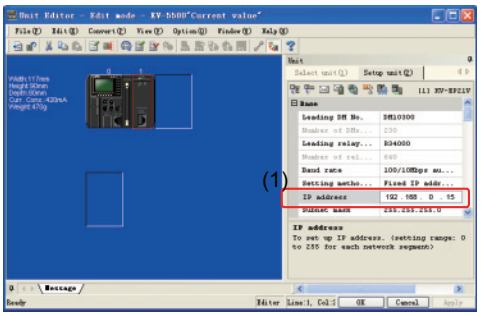
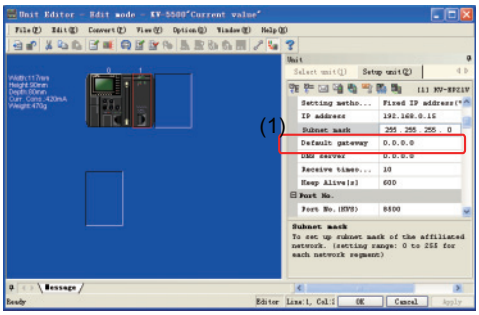
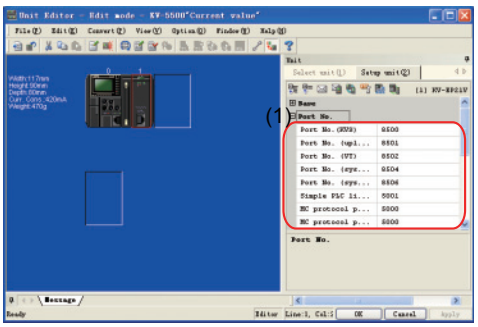
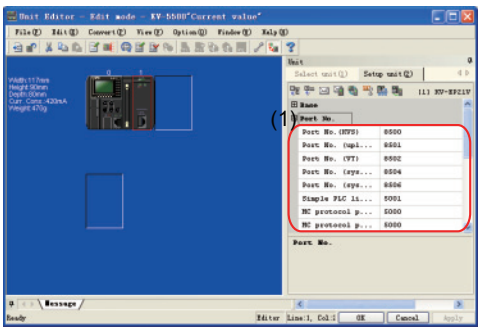
No.	Measures
5	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether target unit has established connection with other scanner units. Check application type setting in the connection setting ((1) in right figure) to be "exclusive owner" connection, whether connected with multiple scanner units. • When multicast is used, check whether the same RPI (communication period) ((2) in right figure), connection type ((3) in right figure), connection point (tag name) ((4) in right figure), data size ((5) in right figure), and send trigger ((6) in right figure) are set to all connections in multicast.  • At power supply ON/OFF of EtherNet/IP Units, or EtherNet/IP Unit setting change, such errors may occur. In this case, it will be recovered automatically. The time required for automatic recovery is related with RPI (communication period) and time out setting. If time out value is too long, the recovery time may be shortened by restarting the power supply of target unit. If error occurs frequently, please check whether there is any load on the network, or whether supply voltage is unstable. • If there is no problem in the setting, please consult the target unit producer. To consult the target unit producer, please check "Necessary information for consultation (1)" in advance.
6	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether the connection size supported by the target unit (or router) is correct. • If requested connection size of the unit varies with the number of connected IO modules, it must be set to appropriate connection size value via parameter setting in the connection setting of EtherNet/IP setting ((1) in right figure). • When tag is used for communication, please check whether the specified data size in the connection setting ((2) in right figure) is consistent with tag size in the target unit.  • At power supply ON/OFF of EtherNet/IP Units, errors may occur. In this case, it will be recovered automatically. In case of frequent occurrence, please check whether the supply voltage is unstable. • If there is no problem in the setting, please consult the target unit producer. To consult the target unit producer, please check "Necessary information for consultation (1)" in advance.

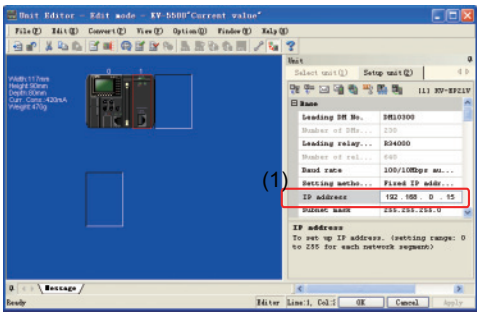
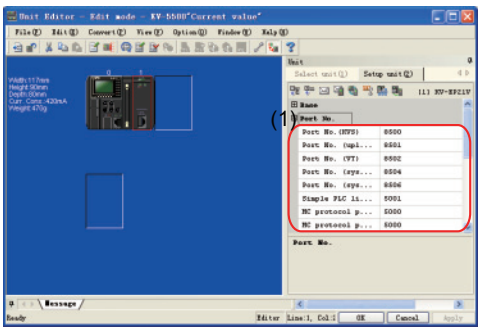
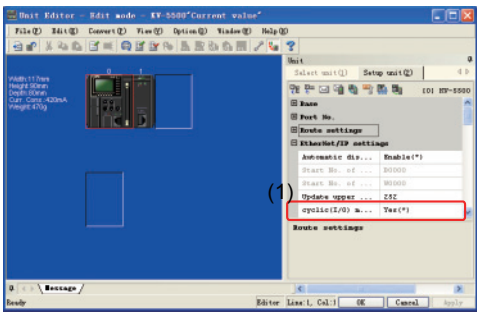
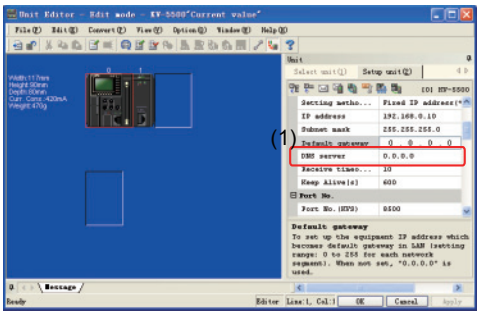
APPENDIX

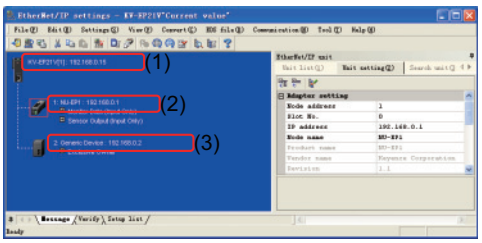
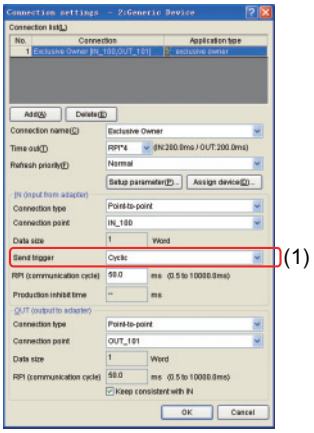
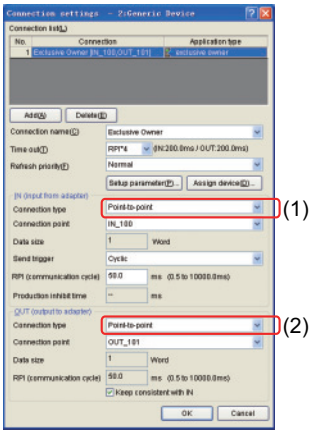
No.	Measures
7	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check cyclic (I/O) messages function of the target unit is OFF. • Check whether target unit is in ready status to send data. • If there is no problem in the setting, please consult the target unit producer. To consult the target unit producer, please check "Necessary information for consultation (1)" in advance.
8	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check time out, and RPI (communication period) value supported by the target unit, set time out ((1) in right figure) and RPI (communication period) in the connection setting of EtherNet/IP setting ((2) in right figure) to appropriate value. • If there is no problem in the setting, please consult the target unit producer. To consult the target unit producer, please check "Necessary information for consultation (1)" in advance.  (1) (2) (2)
9	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check maximum number of connections supported by the target unit, and check whether number of connections is out of the specified range. • If there is no problem in the setting, please consult the target unit producer. To consult the target unit producer, please check "Necessary information for consultation (1)" in advance.
10	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • When application type ((1) in right figure) adopts Listen Only connection, a connection other than Listen Only application type should be firstly established. Check whether Listen Only connection has been established. • If there is no problem in the setting, please consult the target unit producer. To consult the target unit producer, please check "Necessary information for consultation (1)" in advance.  (1)
11	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether the established connections exceed the number supported by the target unit. • If there is no problem in the setting, please consult the target unit producer. To consult the target unit producer, please check "Necessary information for consultation (1)" in advance.

No.	Measures
12	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether the set RPI exceeds production inhibit time in the connection setting of EtherNet/IP setting. • If there is no problem in the setting, please consult the target unit producer. To consult the target unit producer, please check "Necessary information for consultation (1)" in advance.
13	• For target unit, Ethernet switch etc on the communication lines, please check whether power supply and cable status are normal. • Check Ethernet link status to be 100Mbps, full duplex link via unit monitor. (in case of 10Mbps or half duplex link, data packet conflict may occur or bandwidth may be insufficient. For the bandwidth required for cyclic (I/O) messages, see "Check communication load", page 2-11.) • Check whether the network contains loop connection. • Check whether bandwidth limit in the Ethernet switch setting is active. (critical value of bandwidth limit might be set to a value less than the bandwidth required for cyclic (I/O) messages. For the bandwidth required for cyclic (I/O) messages, see "Check communication load", page 2-11.) • Check whether there is load on the network. (check whether packet loss or error data packet increases via Unit Monitor.) • Send undesired multicast packet from other EtherNet/IP Devices, check whether there is load on the network. (undesired number of multicast packets (pps) may be checked via communication rate monitor of the Unit Monitor.) If there is any problem, please consider the following measures. • The Ethernet switch being used is changed to the type that supports multicast packet filter. • Connection type of sending end unit is changed from multicast to point-to-point. • Increase RPI of the sending end unit. • Check whether network load on the target unit exceeds the allowable bandwidth. • Check whether unit of the same IP address as target unit exists in the network. (in case of duplicate IP address, NS LED for the target unit illuminates in red.) • If time out value is too short, time out setting must be changed via the connection setting of EtherNet/IP setting. • If there is no problem in the setting, please consult the target unit producer. To consult the target unit producer, please check "Necessary information for consultation (1)" in advance.
14	• For target unit, Ethernet switch etc on the communication lines, please check whether power supply and cable status are normal. • Check whether the IP address specified in EtherNet/IP setting is consistent with IP address of the target unit. • Check whether IP address of the target unit is set. (when IP address is not set, NS LED of target unit goes out.) • Check whether unit of the same IP address as target unit exists in the network. (in case of duplicate IP address, NS LED for the target unit illuminates in red.) • If there is no problem in the setting, please consult the target unit producer. To consult the target unit producer, please check "Necessary information for consultation (1)" in advance.

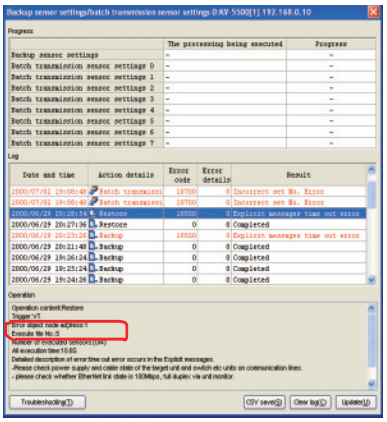
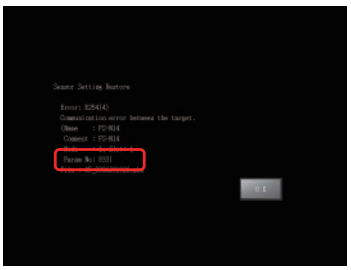
No.	Measures
15	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Delete ((1) in right figure) connections of the target unit, reduce the number of connections, or increase the time out ((2) in right figure). • If there is no problem in the setting, please consult the target unit producer. 
16	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether target unit has established connection with other scanner units. • If there is no problem in the setting, please consult the target unit producer. To consult the target unit producer, please check "Necessary information for consultation (1)" in advance.
17	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether inter-sensor communication error occurs on sensor.
18	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether inter-sensor communication error occurs on sensor. • Check whether unsupported sensor is connected.
19	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether the connected sensor does not meet the specified combination.
20	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether inter-sensor communication error occurs on sensor. • Check whether the connected sensor is restarting (after the restarting is completed, recover automatically by retrying).
21	• Check if the connected unit is compatible with unit set in EtherNet/IP setting. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether compatibility check of EtherNet/IP setting, and cyclic (I/O) messages setting ((1) in right figure) are correct.  For details on compatibility check, see "Compatibility check", page 4-18.
22	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting.

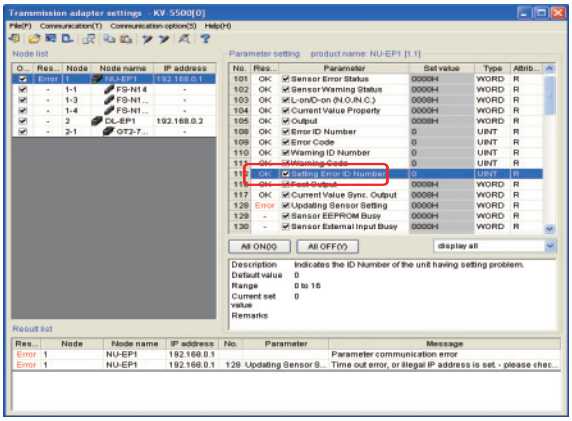
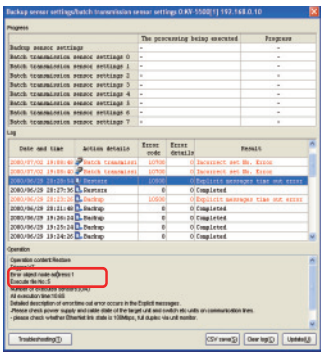
No.	Measures
23	• Check whether IP address setting ((1) in right figure) is correct. 
24	• Check whether default gateway setting ((1) in right figure) is correct. 
25	• Check whether routing setting ((1) in right figure) is correct. 
26	• Check whether port No. setting ((1) in right figure) is correct. 
27	• Hardware fault may occur. Please contact the nearest office.

No.	Measures
28	• Check whether the IP address setting ((1) in right figure) of the EtherNet/IP Unit is the same as IP addresses of all nodes on the network. 
29	• Check whether port No. setting ((1) in right figure) is duplicate with the port No. reserved for the system (67, 8503, port No. (system extension), 8505, port No. (system extension 2)). 
30	• Check whether cyclic (I/O) messages load factor exceeds the specifications of the EtherNet/IP Unit. • When a cyclic (I/O) messages stop (restart) request relay is used to change the communication object node, auto cyclic (I/O) messages start ((1) in right figure) is set to "Disable", at the same time, total communication load on cyclic (I/O) messages nodes should not exceed the specifications of the EtherNet/IP Unit.  • For communication load of cyclic (I/O) messages, see "Check communication load", page 2-11.
31	• Check whether the setting of DNS server ((1) in right figure) is correct. 

No.	Measures
32	• Check whether IP address setting ((1) in right figure) of the EtherNet/IP Unit is the same as the IP address setting ((2) in right figure) of various adapter units registered on the scan list. 
33	• Check if the connected unit is compatible with unit set in EtherNet/IP setting. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether the setting of send trigger ((1) in right figure) is correct in connection setting of EtherNet/IP setting. • If there is no problem in the setting, please consult the target unit producer. To consult the target unit producer, please check "Necessary information for consultation (1)" in advance. 
34	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether connection type setting ((1) and (2) in right figure) is correct in the connection setting of EtherNet/IP setting. • If there is no problem in the setting, please consult the target unit producer. to consult the target unit producer, please check "Necessary information for consultation (1)" in advance. 
35	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether configuration of rack configuration unit is correct. • If there is no problem in the setting, please consult the target unit producer. to consult the target unit producer, please check "Necessary information for consultation (1)" in advance.
36	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether target unit can send data. • If there is no problem in the setting, please consult the target unit producer. To consult the target unit producer, please check "Necessary information for consultation (1)" in advance.

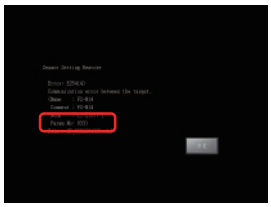
■ Troubleshooting (Sensor application)

No.	Function cause	Measures
100	• Backup sensor settings • Batch transmission sensor settings • Sensor setting command • Transmission adapter settings	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check object parameters of the target unit, or definition of the service according to the sensor (adapter) manual. Check inaccessible parameter No., parameter name or service No. through the following steps. **Backup sensor settings** (1) Check "Error Parameter No." from operation log displayed through "Unit Monitor" > "Sensor Application" of KV STUDIO.  (2) during VT execution, check "Parameter No." in VT screen.  (3) During execution of Ladder program, check current value of the "Error Parameter No." in the unit data memory being used. * view parameter name via "Transmission adapter settings" of EtherNet/IP setting. **Batch transmission sensor settings** Check steps are the same as (1), (3) in the backup sensor settings. * Parameter name can be checked in "Setup batch transmission sensor settings" of the EtherNet/IP setting. **Sensor setting command** SPR/SPWR command: check "Parameter No." (the 4th operand) of the command. SSVC command: check "Service No." (the 4th operand) of the command. * Parameter name can be checked in "Setup batch transmission sensor settings" of the EtherNet/IP setting.

No.	Function cause	Measures
		Transmission adapter settings Check error parameter No. and parameters in "Transmission adapter settings" of the EtherNet/IP setting.  • If there is no problem in the setting, please consult the target unit producer. To consult the target unit producer, please check "Necessary information for consultation (2)" in advance. Reference Error may occur during continuous access, subject to different target units. In this case, after "Continue Operation in Case of Error" is set to "Enable", the problems may be solved. For continue operation in case of error, see 📖 "Setting of operation at error", page 7-30 (backup sensor settings function).
101	• Backup sensor settings • Batch transmission sensor settings • Sensor setting command • Transmission adapter settings	• Check whether the connected unit is consistent with the unit in the scan list. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check object parameters of the target unit, or the definition of service according to the sensor manual. View unwrittable parameter No. through the following steps. **Backup sensor settings** (1) Check "Error Parameter No." from operation log displayed through "Unit Monitor" > "Sensor Application" of KV STUDIO. 

No.	Function cause	Measures

(2) During VT execution, check "Parameter No." in VT screen.



(3) During execution of Ladder program, check current value of the "Error Parameter No." in the unit data memory being used.

Batch transmission sensor settings

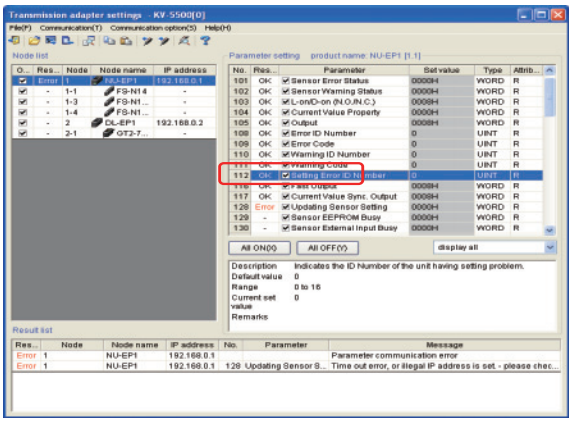
Check steps are the same as (1), (3) in the backup sensor settings.

Sensor setting command

Check "Parameter No." (the 4th operand) of the command.

Transmission adapter settings

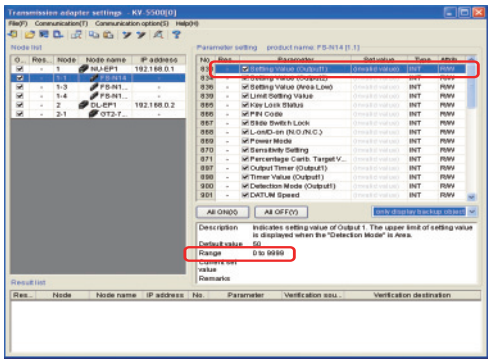
Check error parameter No. via "Transmission adapter settings" of the EtherNet/IP setting.

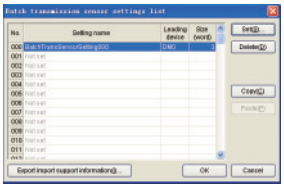
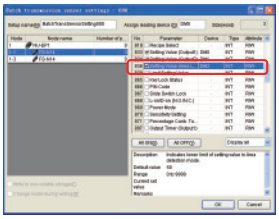
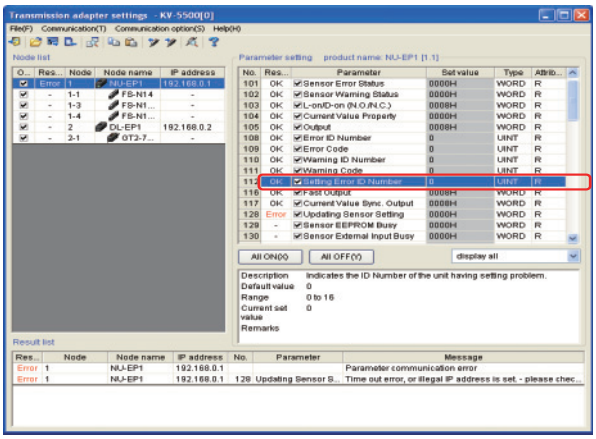


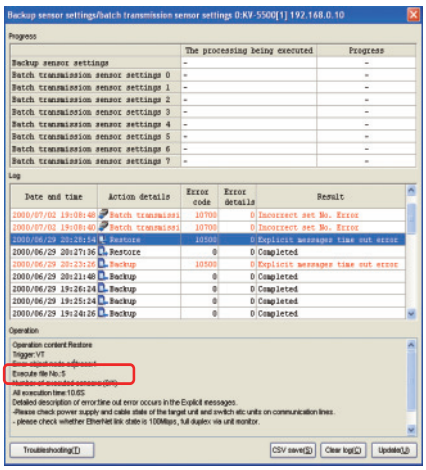
- Check whether the value written in object parameters is within the setting range according to the sensor manual.
  Check the value to be written through the following steps.

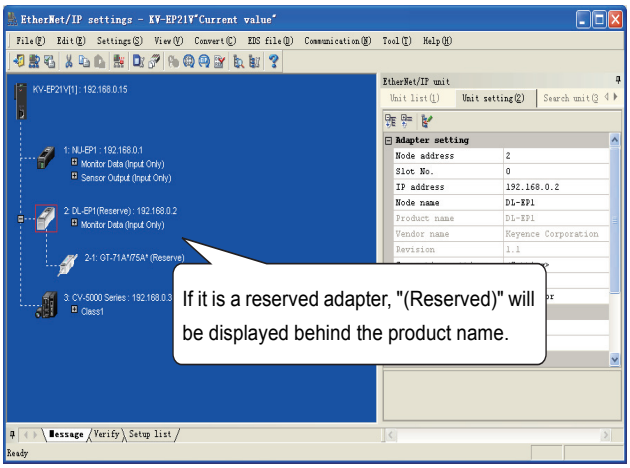
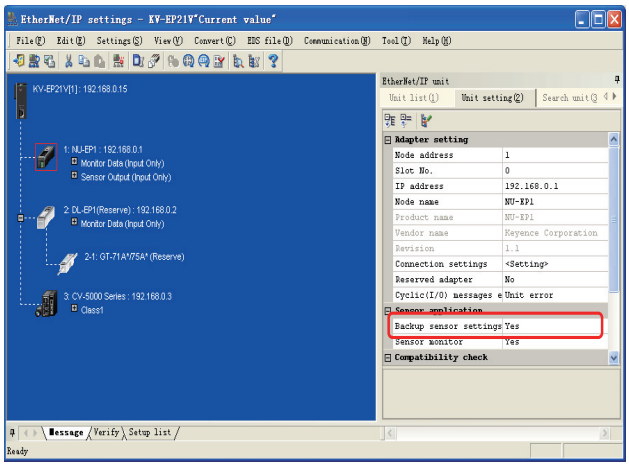
Backup sensor settings

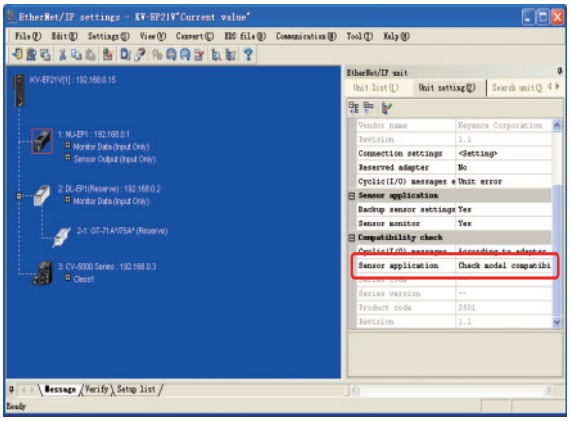
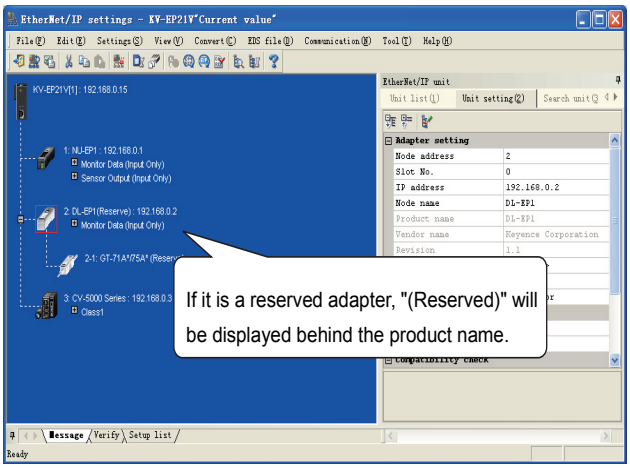
Open the restored file, and check the set value of the error parameter and parameter value range in "Transmission adapter settings" of the EtherNet/IP setting.

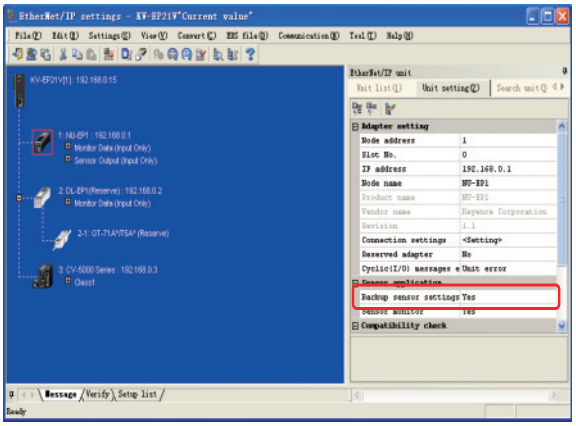
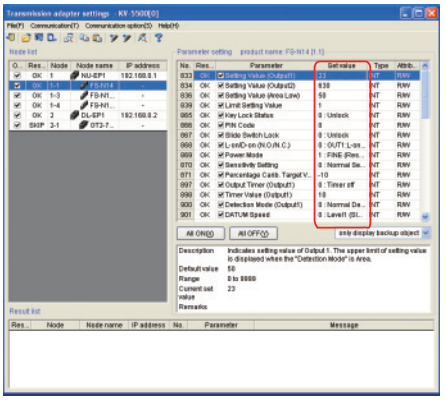


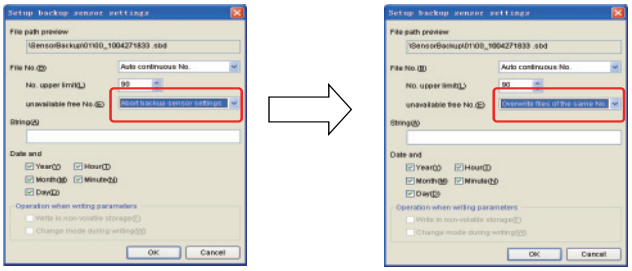
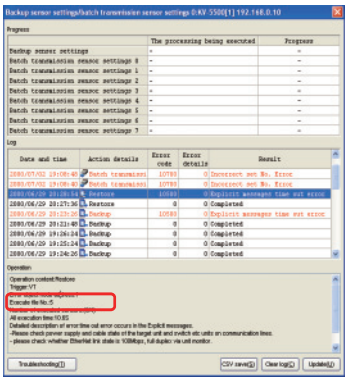
No.	Function cause	Measures
		Batch transmission sensor settings (1) Check the device assigned to error parameter in "Setup batch transmission sensor settings" of the EtherNet/IP setting.   (2) Check current value of the device in (1). **Sensor setting command** Check current value of the devices behind D + 4 of command. **Transmission adapter settings** Check the set value of error parameter in "Transmission adapter settings" of EtherNet/IP setting.  • If there is no problem in the setting, please consult the target unit producer. Before consulting target unit producer, always check "Necessary information for consultation (2)" in advance. Reference Subject to different target units, error may occur during continuous access. In this case, after "Continue Operation in Case of Error" is set to "Enable", the problems may be solved. For continue operation in case of error, see "Setting of operation at error", page 7-30 (backup sensor settings function).

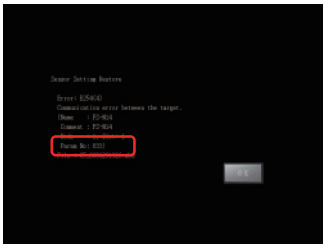
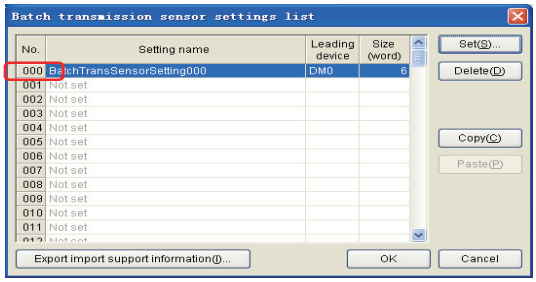
No.	Function cause	Measures
102	• Backup sensor settings • Batch transmission sensor settings • Sensor setting command • Transmission adapter settings	• Check whether the unit in scan list is connected correctly. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • During cyclic (I/O) messages, whether network is connected correctly may be checked by confirming whether cyclic (I/O) messages is normal. Check whether cyclic (I/O) messages is normal via KV STUDIO workspace, or "Normal Node Table of Cyclic (I/O) messages" of the data memory. For specific measures, see troubleshooting No.13.
103	• Backup sensor settings • Batch transmission sensor settings • Sensor setting command • Transmission adapter settings	• Check whether project is transmitted in the execution process, or Reset service is executed.
104	• Batch transmission sensor settings • Sensor setting command • Transmission adapter settings	• Check whether object parameter No. is correct. Check error parameter No. through the following steps. **Batch transmission sensor settings** (1) Check "Error Parameter No." from operation log displayed through "Unit Monitor" > "Sensor Application" of KV STUDIO.  (2) Check current value of "Error Parameter No." in unit data memory being used. **Sensor setting command** Check "Parameter No." (the 4th operand) of the command. • Check whether processing request executed to read/write attribute of the object parameters is correct. For read/write attribute of the object parameters, check attribute of error parameter in "Setup batch transmission sensor settings" of the EtherNet/IP setting.

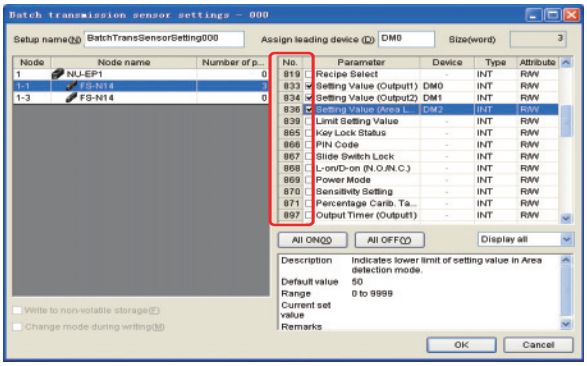
No.	Function cause	Measures
105	• Backup sensor settings • Sensor setting command	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether the sensor of specified node address/slot No. is set in the scan list, whether it is set as reserved adapter.  • Check whether Backup Sensor Settings of sensor of the specified node address/slot No. is set to "Enable" (only for Backup Sensor Settings). 

No.	Function cause	Measures
106	• Backup sensor settings • Batch transmission sensor settings • Sensor setting command • Transmission adapter settings	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether "Compatibility Check" > "Sensor Application" of the EtherNet/IP setting is set correctly. "Compatibility check", page 4-18.  • If backup file is different from sensor information (detailed complete code are stored in 101-107), open backup file, and check whether corresponding sensor information is correct in transmission adapter settings in the EtherNet/IP setting.
108	• Sensor setting command	• Check Ethernet setting.
109	• Backup sensor settings	• Check whether to access the memory card in other path.
110	• Backup sensor settings • Batch transmission sensor settings	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether more than one execution object sensor are set in the scan list, whether set to reserved adapter. 

No.	Function cause	Measures
		• Check whether Backup Sensor Settings of the execution object sensor is set to "Enable" (only for Backup Sensor Settings, Restore Sensor Settings).  • Check whether parameters of the execution object sensor are included in more than one backup files (only for Restore Sensor Settings). Backup file can be opened in "Transmission adapter settings" of the EtherNet/IP setting. 
111	• Backup sensor settings	• Check whether backup file is stored in the memory card.
112	• Backup sensor settings	• Backup file has been damaged, and cannot be restored. During backup file creation, file access may be interrupted forcibly. Please create backup file again.
113	• Backup sensor settings	• Please use memory card with large free space. For the memory card, see 🕮 Chapter "Memory Card" in "User's Manual" of CPU unit.
114	• Backup sensor settings	• Please install the memory card into CPU unit properly. For the memory card, see 🕮 Chapter "Memory Card" in "User's Manual" of CPU unit.
115	• Backup sensor settings	• Check whether to access the memory card in other path. • Check whether write protection of the memory card is enabled (write is prohibited).

No.	Function cause	Measures
116	• Backup sensor settings • Batch transmission sensor settings	• OFF->ON is executed for interrupt request relay, or execution from VT is cancelled, so already interrupted. Check whether interrupt request relay is ON in execution process via Ladder program.
117	• Backup sensor settings	• After Backup Sensor Settings function from other request source is executed, please execute again. For the number of Backup Sensor Settings to be executed at the same time, see "Simultaneous execution of the backup sensor settings function", page 7-30.
118	• Backup sensor settings	• In "Setup Backup Sensor Settings" of EtherNet/IP setting, operation of "when free No. exists" or "when identical files exist "is set to "Stop Backup Sensor Settings". In case of overwrite, please change to "Overwrite Files of the Same No.".  • If there is no problem in the setting, please delete files of the same No., then execute again.
119	• Backup sensor settings	• Check whether the memory card contain any file with the same name as the directory name.
120	• Backup sensor settings	• The version recorded in backup file could not be executed on KV-5500/ KV-EP21V/KV-NC1EP. Check whether the setting for creating backup file is correct.
121	• Backup sensor settings	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check definition of object parameters for the target unit according to the sensor manual. Check parameter No. to which reading is fail through the following steps. (1) Check "Error Parameter No." in "Sensor Application Operation Log" of KV STUDIO. 

No.	Function cause	Measures
		(2) During VT execution, check "Parameter No." in VT screen.  (3) During execution of Ladder program, check current value of the "Error Parameter No." in the unit data memory being used. • If there is no problem in the setting, please consult the target unit producer. Before consulting target unit producer, always check "Necessary information for consultation (2)" in advance.
122	• Batch transmission sensor settings	• Check whether the value stored in batch transmission setting No. of the data memory used by the unit is within the range of 0-127. • Check whether the setting No. in "Setup batch transmission sensor settings" of the EtherNet/IP setting is specified. 
123	• Batch transmission sensor settings	• Write request is executed in the reading process, or read request is executed in the writing process, so cannot be executed. Please modify Ladder program. For maximum number of batch transmission sensor settings to be executed at the same time, see "Notice on using Batch Transmission Sensor Settings Function", page 7-64.
124	• Sensor setting command	• To access the selected parameters, please check whether device size is correct. Please modify Ladder program to ensure the required device size. Check device size of the parameters through the following steps. (1) Check "Type" of the parameters in "Batch transmission sensor settings" of the EtherNet/IP setting. (2) See "Supported data type", page 7-103, check the device size corresponding to this type.

No.	Function cause	Measures
125	• Sensor setting command	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check object parameters of the target unit, or the definition of service according to the sensor manual. Check parameter No. or service No. failed to access through the following steps. SPR/SPWR command: check "Parameter No." (the 4th operand) of the command. SSVC command: check "Service No." (the 4th operand) of the command. Reference Parameter No., and service No. can also be checked conveniently in "Batch transmission sensor settings" dialog box of EtherNet/IP setting. However, not all parameters can be processed by the sensor setting command. Sensor setting command object parameter is displayed in "Setup batch transmission sensor settings" of EtherNet/IP setting.  • If there is no problem in the setting, please consult the target unit producer. Before consulting target unit producer, always check "Necessary information for consultation (2)" in advance.
127	• Backup sensor settings • Batch transmission sensor settings • Transmission adapter settings	• Check whether the connected unit is compatible with the unit in EtherNet/IP setting. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check definition of mode change for the target unit according to the target unit manual. Check the last three digits of the complete code and detailed complete code, check error content stored by the adapter. If the target unit is KEYENCE unit, for to details on mode change, see appropriate unit manual.

No.	Function cause	Measures
128	• Backup sensor settings • Batch transmission sensor settings • Transmission adapter settings	• Check whether the connected unit is compatible with the unit in EtherNet/IP setting. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check specification of non-volatile storage of the target unit according to the target unit manual. Check the last three digits of the complete code and detailed complete code, check error content stored by the adapter. If target unit is KEYENCE unit, for details on non-volatile storage, see appropriate unit manual.
129	• Backup sensor settings • Batch transmission sensor settings • Sensor setting command • Transmission adapter settings	• In unit setting information of EtherNet/IP Device, IP address setting method is "BOOTP Start", IP address can be assigned from BOOTP server. For IP address setting based on BOOTP function, see "IP Address Setting Procedure When BOOTP is Used", page A-5.
130	• Backup sensor settings • Batch transmission sensor settings • Sensor setting command • Transmission adapter settings	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Please reduce the number of sensors.
131	• Backup sensor settings • Batch transmission sensor settings • Sensor setting command • Transmission adapter settings	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether inter-sensor communication error occurs on sensor.
132	• Backup sensor settings • Batch transmission sensor settings • Sensor setting command • Transmission adapter settings	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether unsupported sensor is connected.
133	• Backup sensor settings • Batch transmission sensor settings • Sensor setting command • Transmission adapter settings	• Check whether the unit in EtherNet/IP setting is consistent with the connected unit. When verifying with the unit on the network, check via "Communication" > "Verify real machine" in the EtherNet/IP setting. • Check whether the connected sensor does not meet the specified combination.
134	• Sensor setting command	• Please transfer correct communication setting information to CPU unit. two transmission methods are available as follows. (1)Transfer project through KV STUDIO During PLC transfer, communication setting information is transferred. (2) Load project via memory card If *.YAS file exists in the folder to be loaded, communication setting information is read during loading.

6 Auto Clock Data Adjustment Function

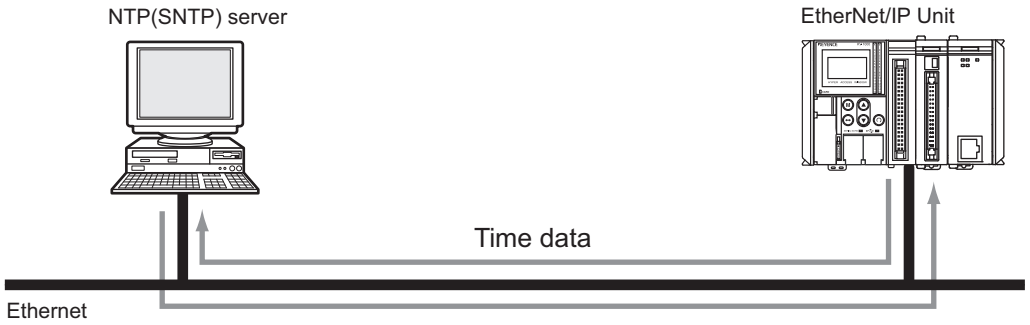
This section describes auto clock data adjustment function and SNTP.

Overview of Auto Clock Data Adjustment Function

Clock data of CPU unit can be adjusted automatically by synchronizing with NTP (SNTP) server. IP address of NTP (SNTP) server and adjustment time can be set in Unit Editor of KV STUDIO. Ladder program is not required for time correction.

SNTP Function and Configuration

SNTP is the abbreviation of Simple Network Time Protocol, which is used to correct time in the network. The server that provides time information is called NTP (SNTP) server.
SNTP is the simple version of NTP, delay in the transfer path is not considered. Since EtherNet/IP Unit uses SNTP for time correction, either NTP server or SNTP server can be used.



For time correction in the network, generally, NTP server with the shortest path in the network is used, such as NTP server in LAN or router with built-in NTP server function .
Although NTP server is publicized by provider or free NTP server is publicized in the Internet, but please do not use NTP server (NTP server based on GPS/atomic clock for time calibration) on the first layer directly.
When an EtherNet/IP Unit is used in a company LAN, discuss which NTP (SNTP) server should be used with the network administrator.
In addition, after Feb. 7, 2036, it cannot be adjusted automatically. (according to the SNTP protocol specification)

Specification of Auto Clock Data Adjustment Function

Item	Description
Protocol	SNTP
Communication mode	UDP/IP
Port No.	123
Update time	When power on PRG -> RUN Specify time or time interval

Device used by Auto Clock Data Adjustment Function

The devices, and buffer memories related with auto clock data adjustment function are as follows.

DM No.*1	Name	Function	Value range	R/W
DM+4	Last auto clock adjustment time (Y/M)	Write date and time when executing time correction. Higher 1 byte, lower 1 byte are divided, and stored as hex numbers respectively. Default value is "0000H".	0000H 0501H to 2402H	R
DM+5	Last auto clock adjustment time (D/H)		0000H 0100H to 1F17H	R
DM+6	Last auto clock adjustment time (M/S)		0000H to 3B3BH	R
DM+7	Auto clock adjustment complete code	Store the value when executing time correction. Default value is "0".	0 to 12	R

*1 DM No. is expressed with the offset from the leading DM No. set in Unit Editor.

Error on using Auto Clock Data Adjustment Function

Execution result of the auto clock data adjustment function is stored in auto clock adjustment complete code (leading DM of KV-EP21V + 7, buffer memory address #7). Complete code is cleared and changed to "0" in case of power ON or PRG -> RUN. Content of the values is as follows.

Complete code (decimal)	Item	Description
0	Clock adjustment not execute	After power on, and PRG->RUN, clock adjustment is not executed.
1	Clock adjustment end normally	Clock adjustment is ended normally.
2	Incorrect address setting of NTP server	IP address of NTP (SNTP) server is "0.0.0.0".
3	Incorrect setting data	The values set for items are out of range.
4	Port opening failure	Since No. 123 port has been used, port opening fails.
5	Send failure	Send is not completed normally.
6	receive failure	Receive end normally.
7	Receive time out	In the set time, NTP (SNTP) server does not respond.
8	Received data packet exception	The received data packet is too short. Or data packet is received from unspecified NTP (SNTP) server.
9	Receive time exception	The time received from NTP (SNTP) server is before 2004 or behind Feb. 7, 2036.
10	Incorrect SNTP/DNS server setting	DNS server is not set when SNTP server is set in host name format.
11	DNS server connection failure	Cannot be connected to DNS server.
12	Failed to acquire IP address of SNTP server	Cannot acquire IP address of SNTP server from DNS server.
13	IP address is not assigned	IP address has not been assigned. Check the setting of "IP Address Setting Method", and check whether there is any exception in BOOTP server setting or communication line.

Steps for Setting Auto Clock Data Adjustment Function

Steps required to use auto clock data adjustment function are described below.

Unit Installation

Check the installation environment, install the EtherNet/IP Unit and connect to the Ethernet.

"Chapter 2 UNIT INSTALLATION", page 2-1

Unit Setting

Use Unit Editor to set up EtherNet/IP Unit functions and transfer the settings to PLC.

"3-1 Unit Editor Setting", page 3-2

The setting items of auto clock data adjustment function are as follows.

NTP(SNTP) server…Specify the IP address of the used NTP(SNTP) server.

"NTP(SNTP)server", page 3-16

Auto clock adjustment …Set to "Specify time" when adjusting at specified time.
Set to "specify interval" when adjusting at specified interval.

"Auto Clock Data Adjustment Function", page 3-15

Specify time

Clock adjustment time … Set the time to adjust time.

"Clock adjustment time [h]", page 3-16

Specify interval

Clock adjustment interval ... Set the interval to adjust clock.

"Clock adjustment time [m]", page 3-16

Set "SNTP communication time out" or "GMT offset"

"SNTP communication time out [ms]", page 3-15, "GMT offset", page 3-16

* In addition, common settings of functions such as "Leading DM No.", "Leading relay No.", "IP address" and "Subnet mask", are necessary for operation of EtherNet/IP Units.

Trial run

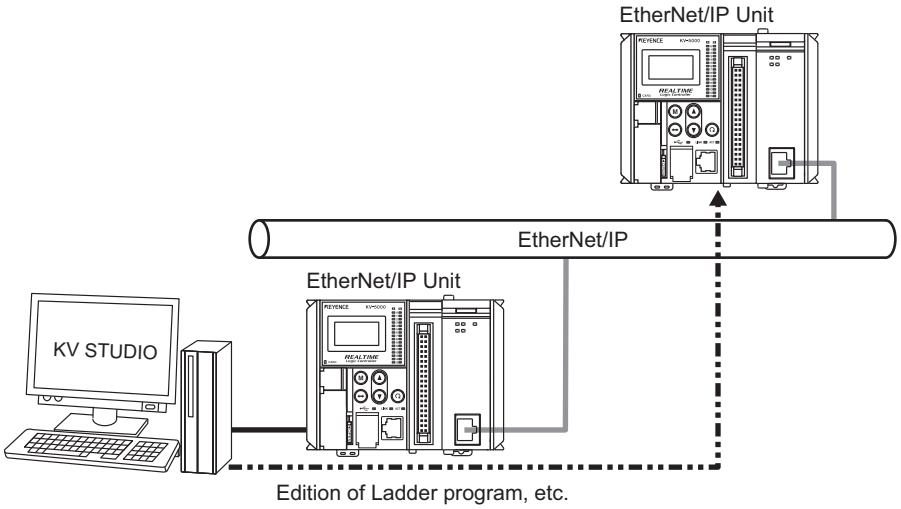
Check the DM (leading DM + 4 to 6) storing the last auto clock adjustment time to confirm whether the clock data of CPU unit is adjusted. Check the error details in DM (leading DM+7) storing the auto clock adjustment complete code if DM value is "0000H".

"Device used by Auto Clock Data Adjustment Function", page A-40

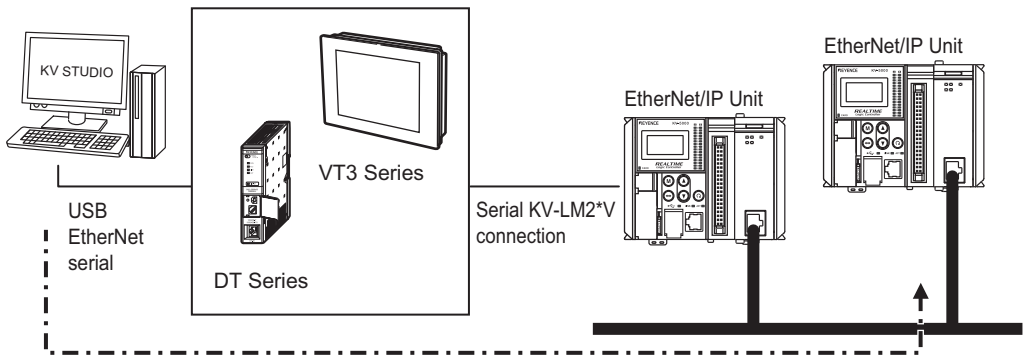
EtherNet/IP Route Connection

If "EtherNet/IP Route" is selected as the communication destination of the Ladder Support Software KV STUDIO, an Ethernet connection can be used for communication with other EtherNet/IP Units connected to the EtherNet/IP Unit.

For EtherNet/IP route connection setting, see "KV STUDIO User's Manual".



Reference A KV-5500/5000/3000 or KV Nano Series which is connected to a VT3 Series touch panel display/DT Series data memory terminal may be used for connection (VT/DT route).

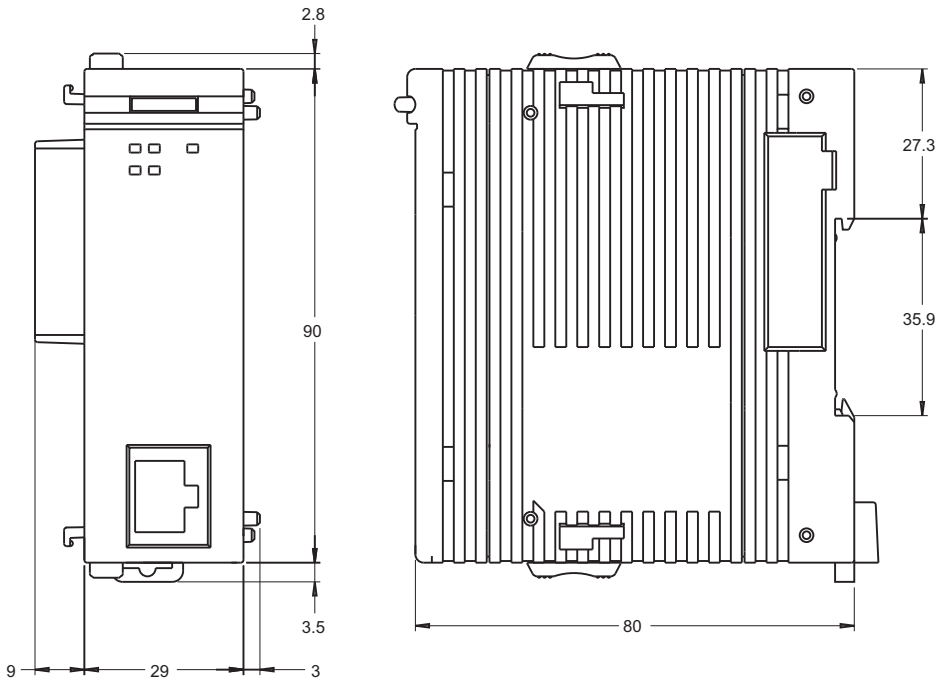


8 Dimension

This section describes unit dimensions.

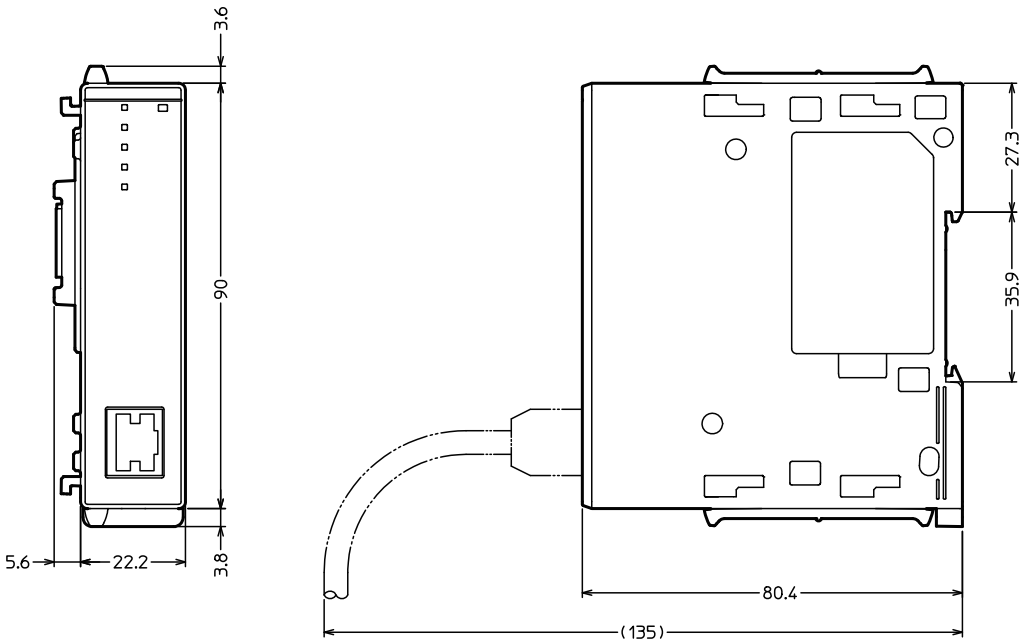
■ KV-EP21V

Unit: mm



■ KV-NC1EP

Unit: mm



* For unit dimensions of the KV-5500, see the 📖 "KV-5500/5000/3000 Series User's Manual".

9 ASCII Code Table

This section describes ASCII code table.

Lower 4 bits \ Upper 4 bits	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
HEX																
Binary	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0 0000	NUL	OLE	(SP)	0	@	P	`	p				ー	タ	ミ		
1 0001	SOH	DC1	!	1	A	Q	a	q			。	ア	チ	ム		
2 0010	STX	DC2	”	2	B	R	b	r			「	イ	ツ	メ		
3 0011	ETX	DC3	#	3	C	S	c	s			」	ウ	テ	モ		
4 0100	EOT	DC4	$	4	D	T	d	t			、	エ	ト	ヤ		
5 0101	ENQ	NAK	%	5	E	U	e	u			・	オ	ナ	ユ		
6 0110	ACK	SYN	&	6	F	V	f	v			ヲ	カ	ニ	ヨ		
7 0111	BEL	ETB	’	7	G	W	g	w			ァ	キ	ヌ	ラ		
8 1000	BS	CAN	(	8	H	X	h	x			ィ	ク	ネ	リ		
9 1001	HT	EM	)	9	I	Y	i	y			ゥ	ケ	ノ	ル		
A 1010	LF	SUB	*	:	J	Z	j	z			ェ	コ	ハ	レ		
B 1011	VT	ESC	+	;	K	[	k	{			ォ	サ	ヒ	ロ		
C 1100	FF	→	,	<	L	＼	l	|			ャ	シ	フ	ワ		
D 1101	CR	←	ー	=	M	]	m	}			ュ	ス	ヘ	ン		
E 1110	SO	↑	.	>	N	^	n	―			ョ	セ	ホ	゛		
F 1111	SI	↓	／	?	O	_	o				ッ	ソ	マ	°		

APPENDIX

10 Index

This index of terms used in this Manual is arranged in alphabetical order.

Symbol

"Search unit" tab 5-24
"Unit List" tab 5-16
"Unit Setting" tab 5-22

A

About KV-EP21V 1-2
Applicable cable 2-8
ASCII code table A-44
Assembly object (Class ID:04H) 4-146
Assign bit device leading No. 3-11
Assign word device leading No. 3-11
Assignment method of CPU device 4-43
Auto clock data adjustment function 1-5, 3-15, A-39
  Auto clock adjustment 3-15
  Clock adjustment interval [m] 3-16
  Clock adjustment time [h] 3-16
  Clock adjustment time [m] 3-16
  Clock adjustment time [s] 3-16
  Error on using auto clock data adjustment function A-40
  GMT offset 3-16
  GMT offset [h] 3-16
  GMT offset [m] 3-16
  GMT offset [s] 3-16
  NTP (SNTP) server 3-16
  SNTP communication time out [ms] 3-15
  Specification of auto clock data adjustment function A-39
  Steps for setting auto clock data adjustment function A-41
  The device used by auto clock data adjustment function A-40
Auto clock data adjustment function overview A-39
Auto start cyclic (I/O) messages 3-11

B

Backup sensor settings 7-6
Backup sensor settings file 7-10
Backup sensor settings setting 7-12
Batch entry and batch replacement of IP address 5-41
Batch transmission sensor settings 7-48

C

Calculate cyclic (I/O) messages load factor 5-68
Calculation and restriction of communication load (load factor) 4-56
Calculation method of load factor 4-58
Calculation of load factor 5-68
Call method of sensor monitor screen of VT3 Series 7-45
Call method of special screen of VT3 Series ...7-14
Check communication load 2-11
Check Installation Environment 2-2
CIP General Status list 4-155
Command list related with CIP character string type data 4-176
Command list related with CIP messages 4-176
Command related with CIP data 4-176
Communication rate 3-6
Compatibility check for sensor application 7-5
Connection Manager object (Class ID: 06H) .4-147
Connection setting 4-24, 5-31
Connection to EtherNet 2-8
Connector for KV-EP21V 2-12
CPMGET 4-182, 4-194
CPMSET 4-177, 4-192
CPSASC 4-189, 4-198
Cyclic (I/O) messages error A-8
Cyclic (I/O) messages error detection mask time (connection) [s] 3-12
Cyclic (I/O) messages error detection mask time (disconnection) [s] 3-12
Cyclic (I/O) messages function 4-6

D

Default gateway 3-7
Device and Command of Simple PLC Link Function 13-19
Device for publicizing PLC status 4-66
device or node status acquisition function 4-159
Device used by KV-EP21V A-2
Device used for explicit messages communication 4-99
Device used in backup sensor settings function 7-18
Devices and programs used in cyclic (I/O) messages 4-63
Devices used in batch transmission sensor settings function 7-56
Dimension A-43
Display contents of sensor monitor screen of VT3 Series 7-46
DNS server 3-8

E

Enable IGMP query send 3-13
Error list A-8
EtherNet Link object (Class ID: F6H) 4-152
EtherNet Switch Used 2-9
EtherNet/IP 1-10
EtherNet/IP route connection function A-42
EtherNet/IP setting 5-2
EtherNet/IP unit area 5-15
sensor service execution command:SSVC (only for EtherNet/IP units from KEYENCE) 7-74

Execution of backup sensor settings function with VT3 Series 7-14
Explicit messages (client) function 4-96
Explicit messages (server) function 4-119
Explicit messages time out [ms] 3-12

F

Flow of cyclic (I/O) messages from setting to operation 4-9
FTP client setting 12-5
FTP command list 11-27
FTP server function 11-2
FTP server RUN/PROG switching 3-14
FTP server setting 3-14
Enable FTP server 3-14
Password 3-14
Function list related with CIP character string type data 4-191
Function list related with CIP messages 4-191
Function related with CIP data 4-191

G

General specification 1-8
Grounding (installation) 2-15

I

Identity object (Class ID:01H) 4-141
IGMP query send interval [s] 3-13
Inspection 2-16
Installation to Unit 2-7
Installation 2-7
Removal 2-7
IP address 3-7
IP address setting method 3-6

K

Keep-alive [s] 3-8

L

Leading DM No. 3-6
Leading multicast address 3-13
Leading relay No. (set up by channel) 3-6
List for unit-specific function of backup sensor settings function 7-38
List of the Complete codes of the Sensor Application Functions 7-97
List of unit-specific commands for backup sensor settings function 7-33
Logging/tracing mail sending 10-15

M

MAC address 14-12
Mail command receiving 10-43
Reply mail when error occurs 10-48
Special command for mail command receiving function 10-46
Mail command receiving function 10-3
Mail communication command Maker 10-49
Mail receiving function specific command 10-45
Maintenance 2-16
Maintenance and Service 2-16
MC protocol communication 3-15
MC protocol port No. (TCP) 3-9
MC protocol communication code 3-15
MC protocol name 3-15
MC protocol name code 3-15
MC protocol port No.(UDP) 3-9
MC PROTOCOL COMMUNICATION FUNCTION 9-2
communication specification 9-4
Device expression 9-13
Device used for MC protocol communication 9-5
For the error code when communication error occurs 9-31
MC protocol data format 9-7
Message Router object (Class ID: 02H) 4-145
Multicast address specifying mode 3-12

N

Names of Parts 1-6
Necessary setting of FTP file transfer 12-12
Necessary setting of logging/tracing transfer 12-34
node status acquisition function steps 4-161
Node status function to acquire 4-157
Number of connections of FTP 11-3
Number of multicast addresses 3-13

O

Output window 5-36
Overview of EtherNet/IP communication function 4-2
Overview of FTP client 12-2
Overview of FTP file transfer 12-10
Overview of FTP Server Function 11-2
Overview of KV DATALINK+ for EtherNet/IP 6-2
Overview of KV-EP21V functions 1-4
Overview of logging/tracing transfer 12-33
Overview of mail command receiving function 10-43
Overview of simple PLC link 13-2

P

PLC event mail sending 10-8
PLC object (Class ID:65H) 4-126
Port No. 3-8
Port No. (KVB) 3-8
Port No. (system extension/system extension 2) 3-9
Port No. (uplink) 3-8
Port No. (VT) 3-9
Power interruption countermeasures 2-15
Precautions on Building EtherNet 2-15
Precautions on using a DC power supply 2-15
Procedures of sensor application setting 7-2

R

RCPSASC 4-187, 4-196
Refresh of CPU device and communication data 4-50
Retry time (system extension) [s] 3-12
RFSCI 4-70, 4-88
RFSCO 4-74, 4-90
Router IP address 3-10
Routing setting 3-10

S

Scan list area 5-9
Scanner Setting 4-19
Selection of EtherNet switch 2-9
Sensor monitor 7-41
sensor parameter read/write command 7-72
Sensor setting command list 7-76
Sensor setting commands 7-72
Sensor setting function list 7-89
Setting of mail command receiving function ..10-44
Setting of sensor application 7-2
Setting of simple PLC link function 13-15
Setting procedure for creating scan list after EtherNet/IP unit searched 5-24
Setup batch transmission sensor settings 5-35, 7-52
Simple PLC link port No. (UDP) 3-9
Simultaneous execution of sensor application functions 7-4
SNTP function and configuration A-39
SNTP Server 3-16
Specific command list for cyclic (I/O) messages 4-69
Specific function list for cyclic (I/O) messages 4-86
Specification 1-8
SPRD 7-77, 7-91
SPWR 7-81, 7-93
SSVC 7-85, 7-95
Start and stop of cyclic (I/O) messages 4-21
Startup and exit KV DATALINK+ for EtherNet/IP 6-3
Startup and exit of EtherNet/IP setting 5-7
Startup and exit of transmission adapter settings function 5-56
Subnet mask 3-7

T

Tag list setting project 4-40
Tag setting 4-38, 5-32
Target IP address 3-10
Target subnet mask 3-10
TCP/IP Interface object (Class ID: F5H) 4-149
The content to be consulted A-18
Transmission adapter settings 5-55
Transmission mode 1-9
Trigger 10-11
Troubleshooting A-16
Troubleshooting (cyclic (I/O) messages function) A-19
Troubleshooting (Sensor application) A-27
TTL for multicast 3-12

U

U_CERR 4-84, 4-95
U_CREG 4-82, 4-94
U_CSTOP 4-78, 4-92
U_CSTRT 4-80, 4-93
U_ELCYC 13-26, 13-30
U_ELSTAT 13-24, 13-29
U_FCSTAT 12-30, 12-32
U_MLATTA 10-32, 10-41
U_MLSTAT 10-34, 10-42
U_MLSUB 10-28, 10-39
U_MLTEXT 10-30, 10-40
U_MLTO 10-26, 10-38
U_MLTOGR 10-24, 10-37
U_MSGRCV 4-110, 4-117
U_MSGSND 4-108, 4-116
U_MSGST 4-112, 4-118
U_MSGTO 4-106, 4-115
U_NDSTAT 4-166, 4-172
U_NDTO 4-164, 4-171
Unit Monitor 15-2
unit-specific command for backup sensor settings function 7-33
Unit-specific command for explicit messages 4-105
Unit-specific command for node status acquisition function 4-163
Unit-specific command list for explicit messages 4-69, 4-105
Unit-specific command/function for batch transmission sensor settings function 7-68
Unit-specific command/function list for batch transmission sensor settings function 7-68
unit-specific function for backup sensor settings function 7-38
Unit-specific function for explicit messages ...4-114
Unit-specific function list for batch transmission sensor settings function 7-68

Unit-specific function list for explicit messages 4-86, 4-114
Update to the KV STUDIO project. 6-34
Uplink communication function 8-2
Communication specification 8-4
Device used for uplink communication 8-4
Format of command and response 8-6
Response in case of exception 8-32
XYM expression 8-33
U_SBMON 7-34, 7-39
U_SBNAME 7-36, 7-41
U_SLREG 4-168, 4-173
U_STMON 7-69, 7-71

V

VT sensor application screen forced switching relay 7-6

W

What is BOOTP A-5
What is Cyclic (I/O) messages 4-6
What is EtherNet/IP 1-2
What is Number of connections 4-6
What is Unit Editor 3-2
Workspace monitor 15-11

Revision History

Printing Date	Version	Details of Revision
Jun 2013	1st version	

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